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- ## More High-Performance Graphics

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**Window into
WordStar with
Sidekick**

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The Independent Guide to
IBM Personal Computers

COVER STORY/FEATURES

PRO COLUMNS/DEPARTMENTS

Cover Photo/Illustration:
Ryszard Horowitz, Andrzej Dudzinski

What's Inside

Hanging around the PC office coffee machine (and not the water cooler) can be a great way to hear the latest gossip about various writers and get hot tips on the contents of the next issue.

As in most offices today, the social life of the employees of *PC Magazine* centers around the coffee machine. (Popular mythology has it that office life centers around the water cooler, but such a notion does not take into account the prevalence of caffeine addiction among office workers.) Since the coffee machine is on the refrigerator, which is under the bulletin board, which is next to the mail shelves, and since cookies, pastries, and other refreshments are regularly available, people hang out there almost continuously. In fact, the voracious appetites of the editorial staff have become somewhat legendary—an art department staffer was heard once referring to us politely as "that bunch of piranhas."

By a quirk of fate, the office of the person who could benefit most from listening to the gossip that swirls around the coffee machine (that is, the person who writes this column) is conveniently located right opposite this crucial spot. The person in question was within earshot when the following conversation took place.

Hot Tips

Associate editor Lisa Kleinman: "I was talking to Mike Finefrock today. I've never seen him so happy. What's he working on?"

Associate editor Jennifer de Jong: "Well, I've just assigned him the cover story on enhancing the AT."

Kleinman: "So?"

de Jong: "It means that Finefrock gets to stuff every peripheral available for the AT into his machine. With the help of Dick Aarons and Brian C. Hale, he'll be inspecting graphics and multifunction boards, data storage, floppy drives and backup, utilities software, communications packages, and who knows what else. The man's in heaven."

Assistant editor Cheryl Goldberg, who had come to freshen her coffee cup, asked, "Is Jared Taylor also working on that? He seemed especially cheerful yesterday."

De Jong shook her head. "No, but he's got his own project in the issue: the Spreadsheet Clinic. It seems that the Clinic was so popular with our readers that we're bringing it back as a permanent part of the editorial well." She sipped, then continued, "We've also been working on the professional columns, and this issue's set includes pieces by Anthony Barcellos on using math utilities to build up graphics, N.B. Forrest on business forecasting, Dr. Bernard Friedman on using a PC for continuing medical education, and Robin Raskin on fundraising."

PC News News

Assistant editor James Langdell, who had brought along an herbal teabag (he's from California and doesn't know better), grinned and said loudly, "I noticed that the person who writes What's Inside didn't mention that PC News has been totally redesigned. It now not only includes up-to-date hard news, but also the latest in microcomputer gossip, interviews with top members of the industry, and other provocative pieces from the perspicacious pundits at *PC*."

"I heard everything!" a voice answered from the opposite office. "Just for that, I'm going to write my next column about the coffee machine!"

Other Popular Places

Another popular place in the *PC* editorial offices is the Toy Shop, where new hardware and software products can be found. However, in recent weeks the room has been more populated than ever, owing to the appearance of the *PC Magazine* Interactive Reader Service [(212) 696-0360].

PC's editors had been thinking about establishing an on-line bulletin board for a couple of years. However, the final impetus came when we ran a couple of very long programming columns with a lot of intricate numbers. These numbers can

15

cause some enterprising readers to become very confused; as soon as the magazine hit the stands, the phones began ringing off the hook and the staff began bouncing off the wall. Editor Bill Machrone brought together the technical staff and said, "Wouldn't it be better for everybody if we had these programming columns on an electronic bulletin board where everybody can get them accurately and where any bugs can be fixed overnight?"

On-Line Gossip

Serendipitously, technical editor Craig Stark happened to meet Tom Mack of the Capital PC Users Group in D.C. Mack had recently concluded an agreement to supply bulletin board software for the whole public education system of West Virginia. After listening to Stark's story, he sent *PC* a copy of RBBS-PC, which was introduced last year and has become a kind of bulletin board standard. Stark and company modified the software slightly and, in early March, introduced it to *PC*'s readers.

Since then, the electronic bulletin board has been extraordinarily popular. This popularity has done a great deal for Stark's spirits—when the first load of printouts containing approving comments was dumped on his desk, even the smoke from his ever-present pipe seemed to radiate cheer.

Cranky Messages

Unfortunately, this popularity has also led to a certain frustration among *PC* staff members. Since all the really good programs published in *PC* end up online, it stands to reason that *PC*'s staff would also want to take advantage of the service. However, the telephone connection is almost constantly busy, at least during working hours, and so often it is several days before even one editor can make the connection. (Incidentally, *PC* is in the process of expanding the board to handle multiple users, a development that will ease the problem considerably.) And since Stark likes to check up on the progress of his project, there is a good chance that, in the middle of a download, an editor will be faced with a sudden sysop (systems operator) message: "WHY ARE YOU TYING UP THE BULLETIN BOARD?"

Such a message is very traumatic for any self-respecting employee. It can drive one to desperate measures, such as joining the group near the coffee machine and encouraging everyone to put cranky messages on the bulletin board. . . .

Oh, hello, Craig.

■

Introducing
the new
and improved
IBM PC.

Introducing

Desk File Edit Tools Font Style

GEM

ABC

hi.

OK. Take a close look at these two
screens.

One is an IBM PC with PC DOS.
The other is an IBM PC with GEM.

You get to figure out which is which.

The PC DOS screen is the one that
seems to be designed for an engineer. Or
someone with a photographic memory.

It requires you to type and memorize
nonsensical terminology like *c>copy\
myprog2.com\level 1\myprog2.com*. All
just to copy a file.

But most people think in ideas.
Words. And pictures.

Which brings us to the GEM screen.

It's the one with pictures of the things
you use in your office. Like file folders.

Diskettes. And a wastebasket.

Plus words describing the kinds of
things you do in your office. Like
OPEN FOLDER. SAVE FOLDER.
And QUIT.

Copying a file is as easy as pointing
with a mouse (or cursor key–if mice
make you uneasy) to the file you want
to copy. Then you just slide the file
across the screen to the diskette you
want to put it on.

Well, by now we've probably given it
away.

If you guessed that GEM is on the
right-hand screen, you're absolutely
right. And if you think GEM looks easy
to use, you're right again.

Now, given a few pointers, anyone can use an IBM PC.

Have you ever noticed how people in your company get up from their PCs looking rather dazed?

That's called PC DOS anxiety.

And it goes away when GEM enters the picture.

Because with GEM everybody already knows everything they need to know to run a PC.

Like how to point.
Click.
Read a menu.
Open a file folder.
Or pitch a bad idea in the wastebasket.

Who knows, GEM software could even turn people with deep-rooted PC-phobia into absolute PC-enthusiasts.

With GEM software you don't have to switch gears to switch drives. You can just point and click your way from drive to drive. No matter how many drives or diskettes you're using.

GEM file folders hold whatever you put on a diskette. From entire software programs to reports, pictures and presentations.

In fact, GEM file folders can even hold other file folders. And so on.

GEM software even includes "generic" file folders, places to hold random ideas, memos, numbers and the like until you're ready to file them in a GEM folder. Or in the wastebasket.

Part of getting organized is knowing when to let go of outdated files.

GEM can't tell you which files to get rid of. But it can help get rid of them.

And should you toss a file before its time, you even get a chance to change your mind.

If you're clever enough to read these words, you've no doubt figured out what the GEM clock is for. Staying on schedule, for instance. Keeping track of the time it takes to do specific projects. Or getting to your airplane on time.

GEM even includes a calculator, so you can tally up all kinds of important things.

Like the time and keystrokes you save by working with GEM software.

GEM already works with most of the software you already have.

We know what you're wondering.

If GEM software is going to change the way you work with your IBM PC, will you still be able to work with your existing software?

Of course.

GEM works with most important programs that work with the IBM PC.

Like Lotus 1-2-3.™ Symphony.™

Multiplan.® dBASE III.™ Framework.™ And thousands more.

Technically, you see, GEM software doesn't actually change PC DOS. It just hides it.

So your software works just the way it always has. But without the long and cryptic PC DOS start-up procedures.

But the best software for GEM is GEM software.

The GEM COLLECTION
Now you can work with words and pictures together.

The GEM COLLECTION™ is a bundle of three programs, GEM DESK-TOP,™ GEM WRITE,™ and GEM PAINT.™
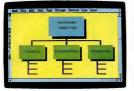
A part of all GEM software, GEM DESKTOP* is the mask that hides PC DOS. It includes the GEM pointer, menu headings, icons and drop-down menus.

So you can point and click your way through anything you'll ever want to use a computer for.

GEM WRITE, by Lifetree Software, Inc., is a word processing program featuring fast, clear and comprehensive editing. It lets you cut and paste, make multiple block moves or even create columns. All without memorizing a single command.

And when words alone won't express what you have to say, GEM PAINT gives you the tools to turn your ideas into pictures. Up to sixteen colors. Paint-brushes, pencils and a straightedge. Plus dozens of shapes and patterns.
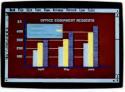
Best of all, GEM WRITE and GEM PAINT work together. So you can work

GEM DRAW
A perfect illustration of the power of GEM software.

GEM WORDCHART
Present it with style.

GEM GRAPH
Let's look at the numbers.

with words and pictures on the same page.

You can also create anything from fine art to line art, whether you can draw or not.

Just put your hand on your mouse and point.

GEM DRAW™ gives you all the tools you need.

Like pencils, geometric patterns, a full palette of colors and an extensive gallery of art to use as you like.

And once you've created a GEM DRAW image, you can stretch it. Shrink it. Duplicate it. Or add text to explain it.

GEM WORDCHART™ is the perfect way to make your point in a big way.

With a choice of several type styles and sizes, plus up to sixteen colors, you can build charts that can be read from across your desk or from the far end of the conference room.

And to really drive your point home, your words can be combined with pictures from GEM DRAW.

The business of creating business graphics just got a whole lot easier.

GEM GRAPH lets you turn numbers into something more tangible. Like pie charts. Bar graphs. Line plots. Even maps. All through the use of simple, well-designed templates.

Where do you get the numbers?

Directly from the business programs you're already using, like Lotus 1-2-3, Symphony, dBASE III or what have you.

Let David Rose tell you about our powerful new ProKey 4.0.

David Rose, inventor of ProKey

Spend 2 minutes learning how to add a powerhouse of function to your keyboard with a terrific new version of ProKey!

"Suddenly others have discovered what RoseSoft has known since we invented the ProKey concept. If your keyboard could work a whole lot harder, your life would be a whole lot easier.

The original idea behind ProKey was a program that would let you store strings of keystrokes you could recall at a touch. Now there's ProKey 4.0 and it's better than ever."

ProKey 4.0 keyword macros unsnarl PC use.

"If you're a serious PC user, you probably use a variety of software programs. Spreadsheet. Word processing. Database. Communications. Plus the special-function programs you use to run your business or department.

And all these programs have different complicated commands that are tedious to type and easily forgotten. How much easier life would be if all you needed to operate your program was a small vocabulary of sensible words.

Want to log onto Dow Jones with your communications package to check on how your IBM stock is doing? Just type the keyword you previously selected for this function, "IBM." Need to print a profit and loss statement? Typing "p&l" is all it takes.

Behind the scenes, ProKey 4.0 checks its memory for the string of commands required to carry out the task and executes them automatically. Forgotten what functions you have available? Just call up the built-in menu that describes them in plain English.

Need to add a function? Enter the commands. Enter a description. Store them both away without leaving the program you're working with.

Built-in editing, English language menus, multi-character macro names and the ability to instantly change sets of functions. These are just four of the exciting new features that make ProKey 4.0 the most powerful macro processor you can buy."

ProKey 4.0 lets you customize your keyboard.

"Only ProKey has the unique Layout program that lets you redesign your keyboard to correct design flaws the manufacturers built in. You can change the location of any key, create a DVORAK layout, or make a duplicate set of arrow keys away from the keypad."

ProKey Is the Industry Standard.

"ProKey has all the features you need to make your life a whole lot easier. And RoseSoft has three years experience supporting customers who use macros. Including over 80% of the Fortune 100.

Don't be misled by the recent claims of ProKey imitators; they're comparing themselves against old versions of ProKey.

The choice is simple. Do you want an unknown, untested product in its first generation, or ProKey 4.0's power and features? The difference in price will hardly pay for dinner. The difference in performance is like night and day."

ProKey 4.0 runs on IBM and other compatible MS-DOS computers, and works with 99% of the software they use. $130 suggested retail price at software dealers everywhere. Or call RoseSoft. (206) 524-2350.

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"KnowledgeMan was very easy to get to know," says Tina, who had no previous experience with software. "You can start doing things right away. I began using it for territory management. Now I'm getting into account management. It seems the more I demand, the more it responds.

"The integration is a real time-saver. It's so natural and flexible. You don't have to exit one function before entering another, so I can work with data bases, statistics, spreadsheets and graphics all at the same time—and even incorporate them into programs.

"With KnowledgeMan, I can keep close track of the sales numbers for each account—when they buy, what they buy and how close I am to meeting my quotas. It's helped me work more effectively and improve service to my customers."

If you're interested in forming a great partnership with KnowledgeMan, contact Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902 (317) 463-2581.

Tina Ferguson
AND KNOWLEDGEMAN

A variety of KnowledgeMan run-ons, including K-Text,™ K-Graph,™ K-Paint,™ and K-Report™ are available from MDBS.

Current version is 1.07 as of 9/10/84. Operating systems: PCDOS, MSDOS, CP/M-80. Minimum RAM required is 256K.

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Corporate Information Sharing. It's been described as the key to increasing a company's productivity. It's also why large networks of PCs are becoming more and more common in the workplace...in spite of the fact that they're costly, difficult to install, and incompatible with much existing software.

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Boasting a data transfer rate in excess of 100,000 BPS, LANLink™ is compatible with a wide range of programs. And because special boards aren't required, installation costs are one-third that of a traditional network.
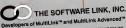
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Get Started With LANLink™ TODAY. Call The Software Link TODAY for complete details and the authorized dealer nearest you. The LANLink™ Starter Kit, priced at $495, comes complete with network software for both a server and a satellite computer. For a limited time, 50 feet of RS-232 cable will be included free of charge.

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LIBRARIES: Hundreds of Functions for Fast Programming

GREENLEAF FUNCTIONS

C use bare-bones language? It does not have built-in (machine dependent) functions for printing or floating point math or string manipulation. That's why it's so portable. That's also why libraries of pre-written functions are such big sellers: bullet-proof routines your application can effortlessly call to get the job done.

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32 DOS extensions: file and directory manipulation for DOS 1.1 and 2.0.

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Over 60 functions set up an interrupt driven scheme with separate transmit and receive ring buffers (characters are simultaneously loaded at one end and transmitted from the other, or vice versa) for an arbitrary number of ports. Interrupt control means you can download a program, service your user command, and does away with the asleep to the separate communications software (and its semantics) you had to use until now.

The Greenleaf Comm Library supports ASCII or binary any parity, any word length, 8250 UARTs, all four Lattice C memory models, Hayes 300, 1200, 1200B and other modems.

Its 80-page manual has examples of each function, discusses asynchronous communications, and both the library and demo programs come with source (a mix of C and assembler)

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LATTICE C-FOOD SMORGASBORD

Decimal Arithmetic. Trigonometric, logarithmic functions, powers, conversion to strings. BCD operations for numbers up to 16 significant digits

Level 0 I/O Functions. Direct operations for screen, keyboard, printer, and asynch port with no dependence on higher level I/O will minimize memory usage and maximize speed.

IBM PC BIOS Interface Access. Gets basic I/O services in ROM BIOS not available from the operating system to get and set video mode, cursor position, color and screen attributes, keyboard shift, scrolling, printer channel, port status

Terminal Independence Package lets you move programs to computers with other types of terminals

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List Price $150.00 #	$115.00	

Quite a treasure. So cost-effective that after using only a couple of functions you'll be saving a bundle compared to writing your own. (It's true, how much do you cost per day?) So why not go for the whole bundle?

BASIC_C
Use Your Knowledge of BASIC to Learn C

I f you're getting the message that switching from BASIC to C would be prudent, you're about to discover that it's back to basics of a different sort. BASIC is far with hidden functions that stripped down C just doesn't have.

Gone are all those hard-to string manipulations like LEFT$, MID$, STRING$, etc (although our library offerings add them back). In C when you reach for even simple innovations like INPUT or PRINT AX.X% — well, sorry to disappoint, but underlying such expressions in BASIC are bulging macros which C cannot have if it is to keep as slim profile.

But now comes BASIC-C and all your old favorites are back. Someone has written the full set of C functions to mimic BASIC's vocabulary, from ABS to WRITE Over 90 routines to open and close files, "field" file buffers, convert their contents from and to strings (the CVT and MKT series), peek and poke, print using, clear screen, "inst", on error goto they're all there. Some have reworked names and syntax to suit C but all are written as one-to-one functional equivalents to the familiar features of BASIC. And they are documented one to a page in alphabetical sequence like the Microsoft manual for added familiarity

So with BASIC-C, when you're thinking INPUT, go ahead. Use it. Or LPRINT or LOCATE or INKEY (but without BASIC-C you will find that every line of code plunges you back in the C arena to figure out how to write it. Someday you'll want to, but for now, BASIC-C will start you programming quickly at the easterner level, so that you can concentrate on C's larger concepts

There's a bonus: an unusually well-written manual with a fine case chapter comparing how BASIC and C go about their tasks. Without question, BASIC-C will ease your transition to C.

Product Code 50900 #	Our Price	
List Price $175.00 #	$145.00	

MULTI-HALO AND THE DOCTOR
Premier Graphics Library Now Supports 19 Boards

I f you've been reading this space, you'll recall our saying that Halo was fast becoming a standard graphics language. It's now become so dominant that the newest incarnation, Multi-Halo, supports nineteen graphics cards, and comes with a multitude of mouse and printer drivers. All with one purchase, replacing the previous one board per copy

Within your Lattice program a function call can reset drivers. You can arrange that your application program doesn't care what board the customer has, you can even switch boards while a program, as when two different monitors are used

Halo is a complete library of graphic functions which can be linked with your Lattice program to create full color charts, graphs, simulations, animation.

Over 150 commands are at your disposal, including plot, line, arc, box, circle, plus single commands to produce bar graphs and pie charts. Pattern-fill and dithering commands give your graphics presence and entire color hues. Rubber-banding draws shapes for interactive users, area moves produce animation, fill and flood commands paint areas. Multi-Halo allows you to define your own world coordinate scheme, divide the screen into windows, and scale graphic figures automatically

Multi-Halo is a library of functions to utilize from your C program. Dr Halo is a standalone program, written in Halo. Its dazzling "four screen becomes a canvas, and a mouse (preferable) your paintbrush to take you where ever your imagination leads. Save the images to disk, run them by with Dr. Halo's slide show feature. Suggestions? Use Dr. Halo as a freehand sketchpad to design what you want your application to do.

	List Price	Code	Our Price
Multi-Halo	50950	$250.00 #	$199.00
Dr Halo	50320	$ 98.00 #	79.00

PMATE
The Programmer's Word Processor

P mate™ was designed for programmers. We'll wager that you cannot find a programmer who has discovered Pmate and moved on to something else.

Pmate is a full screen editor with ten auxiliary buffers for transferring away pieces of text until needed. It uses single key commands to move the cursor, or text, or insert or delete, or rescue several thousand characters of deleted text

It has a format mode for tab setting or wraparound and shaping when it's time to write documentation. Pmate lets you assign chains of commands or strings of text to single keys a keystroke could set up the entire shell of a new C function, for example

Pmate has variables, if-then statements, loops & calculators, and commands decimal to hex to binary and back. You can write compact programs (called "macros") to delete comments, for example, or check syntax, or process long sequences of commands. Macros can alphabetize lists, do row and column math, perform a series of operations on multiple files, even summon other macros

Put another way, Pmate is a text editor with its own built-in interpretive language A language you can use to completely customize this tool editor to your fancy. Possibly the most artful, ingenious program you have ever seen

Product Code 50900 #	Our Price	
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LATTICE WINDOW
All Your Applications Could Have Windows!

W indows are no gimmick. Ask any user of a windowed product. But how do you add this technique to your applications without disappearing for several months of R&D?

With Lattice Window ™ A rare programming tool which will change the way you think of program design. Lattice Window takes over all screen management. It is an extensive set of object code functions which you merely call from your C program

Think of a window as a screen if flexible size. You can tell Lattice Window to open and close up to 255 virtual screens from 1x1 to 255x255 bytes. Then tell "Window" to display any portion of these virtual screens on the physical screen as many as fit wherever you want, overlapping and overlaying at will

Windows no longer needed may be closed Any background area overlaid earlier (which could be a corners of several windows) will pop-back to the screen. Think for a moment what a programming job that technique represents.

To your program, the screened window is the entire screen all row and column references are relative to the window no matter its absolute position in the screen All scrolling occurs only within the active window The cursor will not leave its boundaries until your program says to.

• You can move a window on the screen
• You can open or close any or all of the underlying virtual screen. Or shrink it.
• You can control screen attributes (color blinking, reverse video, etc.)
• You can direct output to either the monochrome or color board

Product Code 50900 #	Our Price	
List Price $295.00 #	$235.00	

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Plink86 can even sub-divide in linked output into multiple files for programs which must span more than one disk. And it produces a symbol map for debugging with Plix86 Plus.

PC Tech Journal calls it "the premier linker and overlay loader that's raising over many of the programming steps around the country."

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Pfix86 Plus is an enhanced version for use with modules linked by Plink86, even those with overlays. It retains the program

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PC News

Lotus & Intel: Power Banking

The power pact sealed, Intel and Lotus are riding high on a new wave of products that will crash the memory barriers of PCs.

Intel's Above Board/AT (left) and Above Board/PC (right).

BY VIRGINIA DUDEK

NEW YORK—Lotus Development has once again broadened its product line and shaken up the industry a bit in the process. A joint agreement with Intel Corporation of Hillsboro, Oregon has yielded the Above Board Expanded Memory Man-

ager products for the IBM PC and compatibles and a new memory-enhancement standard for hardware and software (see "Opening Above Board"). New versions of Symphony and 1-2-3 were announced, as well as a new micro-to-mainframe communications package called Symphony Link.

Above Board comes to the rescue of spreadsheet users who have been complaining that their computer memory is saturated. Presently, a PC's memory cannot exceed the DOS limit of 640K, hindering large applications of spreadsheets and

databases. The Above Board can expand the memory limit to 8 megabytes above 640K.

Above Boards come with print buffers, RAMdisks, and menu-driven installation programs. The Above Board is

Victor Snatched From Defeat

BY CHARLES BERMANT

NEW YORK—Victor Technologies took its case to the top of the World Trade Center, announcing that reports of its demise have been greatly exaggerated. Armed with a revitalized product line featuring two IBM-compatible machines, the company that declared bankruptcy 2 years ago hopes to make a much-improved showing in the next round of the PC sweepstakes.

In addition, Victor has filed suit against Tandy, which called the Victor 9000 an "orphan" in an ad earlier this year (see "Who Steals My PC, Steals Trash," Volume 4 Number 9, p.57). Tandy listed the Victor 9000 as one of the machines it would accept as a trade-in. Victor, which says it has never stopped selling or servicing the 9000, wasn't laughing at Tandy's attempt at advertising humor.

While they have written Vic-

The VPC Hard Disk System

tor a letter of apology, Tandy has not made the public retraction that Victor has demanded. "We have received the suit and do not believe that the ad was illegal," says Tandy senior vice-president Herschel Winn. "We

Compaq's Two New Computers

BY BARBARA KRASNOFF

HOUSTON—Amid laser lights and music videos, Compaq has introduced the latest in its line of PC-compatible computers: the Compaq Deskpro 286 and Portable 286. The machines are based on the 80286 16-bit microprocessor. According to Compaq, they are fully compatible with IBM's PC AT and be-

Power Banking

model comes in two base configurations for the PC, XT, and compatibles and offers up to 2 MB of expanded memory. There is the 64K (with 64K RAM chips) model, expandable to 512K, and the 256K model (with 256K RAM chips), expandable to 2 megabytes.

The Above Board/AT model also has two base configurations for the PC AT: 128K (with 64K RAM chips) expandable to 512K and 512K (with 256K RAM chips) expandable to 2 megabytes.

The Above Board/AT costs $395 for the 64K configuration and $595 for the 256K version. The Above Board/AT sells for $595 and $995 for the 128K and 512K models, respectively.

Symphony, 1-2-3 (Opus 2)

To fill up all this new memory, updated versions of *Symphony* and *1-2-3* were announced. *Symphony* Version 1.1, released in June, can now take advantage of the enhanced memory specifications and address up to 4 MB. Version 1.1 can also interface with the 8087 and 80287 math coprocessor chips. A macro library manager permits users to store macros, numbers, labels and named ranges outside the worksheet.

The new version of *1-2-3* (2.0) will be available this fall and shares some of *Symphony's* enhancements. Both can use the 8087 math chip, and both use sparse matrix techniques to conserve memory and accelerate operations. Sparse matrix techniques use memory only for the cells that actually contain data.

1-2-3 users will also note that Version 2.0 can read *Symphony* spreadsheets. *1-2-3* gains much of *Symphony's* programmability and receives advanced functions such as linear regression. Users will be able to access DOS functions from within the program.

Lotus also announced *Symphony Link*, a micro-to-mainframe communications package that provides direct, two-way data transfer between PCs and mainframes. *Symphony Link* works with Digital Communications Associates, Inc.'s

IRMA board. Both products run together in the IBM 3270 environment and become fully integrated and transparent to *Symphony* once they are installed.

Time Will Tell

In the aftermath of the Lotus announcements, observers applauded the Intel/Lotus memory enhancement standards but also looked to some broader moves on Lotus's part.

"I find it fascinating that Lotus is trying to be the IBM of software," says Tim Bajarin, vice-president of the microcomputer group at Creative Strategies in San Jose, Calif. Refer-

ring to Lotus head Mitch Kapor, Bajarin adds, "At the same time, if anyone could do it, Mitch and his group of executives can."

Bajarin would also like to see *Symphony* become easier to use. While Bajarin acknowledges that a product like *Symphony* cannot avoid a steep learning curve, he believes that the company "still has a lot to do to enhance *Symphony* to make it user friendly."

Scott Smith, vice-president of the Gartner Group in Stamford, Conn., would also like to see more ease of use in *Symphony*. "If there were no *Symphony*," he asks, "would *1-2-3* have just come in and sold all those units?"

accessed by the DOS device driver for the Above Board. Only the Above Board/AT has extended memory, but the accompanying software can fully configure either board for an exact match to your system. Intel calls its device driver the Extended Memory Manager or EMM. During installation, this driver makes recommendations as to the best size for RAMdisks and print spoolers for many popular programs. It sets options on the board through software, without DIP switches or jumpers. It even deallocates bad pages of memory after it informs you of the problem. Then the driver strips itself down to the bare-minimum amount of code necessary to run the board.

Intel says that although the standard is geared to solving "large data" problems, the EMM is fully compatible with multitasking systems.

Programmers will have little difficulty adapting their products to the new standard. The calls that invoke the EMM are much like DOS calls, using a software interrupt vector and passing parameters in registers.

Next Step

The new standard is a powerful argument for the continuation of 8088-based PCs. With the recent price reductions in memory and disk drives, PCs are dirt cheap to build. As Quadram president Leland Strange points out, "You can put 640K of memory on a board for the cost of an 80286. Which would you rather have?"

Other sources say that DOS 4.0 will bridge the differences between extended and expanded memory, while offering multitasking. Windowed multitasking systems will be relatively simple to build in such an environment.

The Lotus/Intel standard solves the "large data" problem, but it is an incomplete solution to the "large program" problem. DOS 4.0, along with advanced program design, may combine RAM-based program overlays and bank switching with multitasking. This combination would far outstrip the operating environments available in the current market.

Opening the Above Board

BY BILL MACHRONE

NEW YORK—Intel and Lotus have taken the wraps off their joint Expanded Memory Specification and simultaneously shucked many of the memory limits previously encountered by power users. Along with the new standard comes a host of

that far. Intel's first consumer product (second, if you count the 8087 math chip) for the PC is the Above Board. This card packs up to 2 MB of RAM, and two Above Boards can coexist in the same system.

Nitty Gritty

The Above Board card comes with sophisticated software to manage the additional memory.

Intel's PC enhancement products (above) are supported by Framework and 1-2-3.

new products from Intel, Lotus, and virtually every other board manufacturer. Other software manufacturers should follow in short order.

The new specification describes a method for bank switching, a technique that allows computers to use more memory than they can actually address. Intel and Lotus have placed the standard in the public domain, making it available to all hardware and software manufacturers. This standard expands the PC's usable memory to 8 MB; however, the first wave of new products won't go

a menu-driven program takes care of configuration, generating a driver that gets added to your existing CONFIG.SYS. The board can appear as three different types of memory to the system: conventional memory, extended memory, or expanded memory.

Conventional memory exists below the PC's natural limit of 640K. Extended memory exists beyond 1 MB and is only accessible by an 80286 running in protected mode, as with the PC AT. Expanded memory is bank switched, or added to the 640K of conventional memory, and is

West Coast Update

PALO ALTO, Calif.—Intel and Lotus Development Corporation held a second press conference on April 24, a few hours after and a continent away from their first one, introducing the Above Board boards and the Lotus/Intel Expanded Memory Specification to members of the West Coast press. The secondary purpose of the event was to sound the trumpet for Intel's Personal Computer Enhancement Operation (PCEO), an Oregon-based division charged with supplying products for the retail personal computer market. Until the formation of PCEO in 1984, Intel was strictly an OEM player. The Above Board/PC and Above Board/AT are PCEO's first major announcements.

Richard Bader, operations manager for PCEO, said the Above Board products and the Lotus/Intel Expanded Memory Specification were intended to meet the needs of a growing number of personal computer users for memory in excess of the 640K limit imposed by PC-DOS. Foremost among those needing additional memory, Bader said, are users creating large-scale spreadsheet models and working with integrated software such as *Symphony* and *Framework*. He also cited the increasing popularity of memory-resident accessory software, such as *Sidekick* and *Spotlight*, as a factor that impels PC users to move beyond 640K.

Accommodation Changes

Jim Kinlan, manager of manufacturing relations for Lotus, announced that Version 1.1 of *Symphony* and Version 2.0 of *1-2-3* would include support for Above Board expanded memory. The *Symphony* revision, scheduled to be available in July, would also include 8087/80287 support, a macro library manager, a price utility for file conversion to and from *1-2-3*, as well as new documentation, Kinlan reported. The new version of *1-2-3*, due out in the fall, would also support the Intel

8087 and 80287 math coprocessors.

Earlier in the day, Microsoft had issued a statement saying that future versions of DOS would be compatible with the Lotus/Intel Expanded Memory Specification.

The room at which the press conference took place was ringed with XTs and ATs running large-memory demonstrations in *Symphony*. There was also one machine running an astonishingly large application in Ashton-Tate's *Framework*. Ashton-Tate has announced it will market an Above Board version of *Framework* in the fall.

Compaq's New Computers *(continued from page 45)*

cause of their 8-MHz capabilities, run software up to 30 percent faster.

The announcements were made in a carefully rehearsed atmosphere of celebratory self-congratulations and high-tech entertainment. At an April 30 stockholders meeting at Houston's Wyndham Hotel, attendees were greeted with a well-orchestrated program that included a multimedia rundown of Compaq's 1984 performance, a showing of the "USA for Africa" music video, and the Pointer Sisters.

During breaks in the proceedings, Compaq president and chief executive officer Rod Canion, along with chairman of the board Ben Rosen, lauded Compaq's staying power in what was a disastrous year for compatible manufacturers.

Cloning Around

"You cannot clone and succeed in this business," asserted Rosen. Rosen then summed up his own philosophy: "To succeed in the business and professional marketplace, you must run all of the industry-standard software and you must run all of

From left to right, the Compaq Deskpro 286 and the Compaq Portable 286.

the industry-standard peripherals and all of the industry-standard networks. But you must also have innovative products with superior performance."

Both the Deskpro and Portable 286 machines are being made available in two models: one with a 1.2-MB disk drive and another with a 20-MB fixed disk.

The Portable 286 Model 1 resembles the present Compaq Portable, including a 9-inch text/graphics monitor and IBM-compatible keyboard. The computer runs at both 6 and 8 MHz. Besides the disk drive it includes: 256K RAM; a real-time clock; three AT-compatible expansion slots; standard interfaces for printers, asynchronous communications, and RGB

Sorcim/IUS, vendor of *SuperCalc 3*, issued a press release congratulating Lotus for including 8087/80287 support in the next versions of *1-2-3* and *Symphony* (*SuperCalc 3* has included support for the math coprocessors since last autumn). Sorcim also let it be known that Above Board support would be included in the next incarnation of *Super-Calc 3*.

Notably silent this day was IBM, whose TopView integrating environment could benefit greatly by emancipation from the 640K memory limit. IBM has announced no plans to modify TopView. —Craig Stinson

monitors; and a security lock. It will retail for about $4,499.

Prime Cuts

The fixed-disk Portable holds 640K RAM, two expansion slots, along with the 20-MB hard disk. It will retail for about $6,299. Both machines can accommodate up to 2.6 MB of RAM, and an optional internal fixed-disk backup system. Other options for the Portable 286 include a 512K upgrade, an add-on 20-MB fixed disk drive, a second 1.2-MB disk drive, MS-DOS Version 3, and a standard 360K disk drive.

The Compaq Deskpro 286, a desktop version of the new computer, features the 80286-based CPU, an AT-compatible keyboard, and an optional 12-inch text/graphics monitor. The machine, which also runs at both 6 and 8 MHz, can accommodate up to 70 MB of optional fixed-disk memory, 8.2 MB of RAM, and four half-height internal

Rod Canion, president, Compaq.

storage devices, including a fixed-disk tape backup.

The Deskpro Model 1 comes with: 256K RAM, a 1.2-MB high-density disk drive, real-time clock, five expansion slots, security lock, and all the interfaces that the Portable holds. It will retail for $4,499 with a monitor. The Model 2 Deskpro comes with: 512K RAM, the 1.2-MB high-density disk drive, a 30-MB fixed-disk drive, and four expansion slots.

Compaq also announced price reductions in its existing models, dropping its dual disk drive portable from $2,995 to $2,699, the Compaq Plus from $4,995 to $3,999, and the Deskpro Models 2,3, and 4 to $2,899, $4,499, and $5,799 respectively. ∎

Big Blue Prints . . . IBM's new $549 Proprinter contains less than 60 moving parts, and offers versatile printing capabilities, including APA graphics, multiple fonts, and single sheet and tractor form paper feeding. It prints at speeds ranging from 200 cps (draft

IBM's new Proprinter is compatible with the entire line of IBM Personal Computers.

mode) to 40 cps (near-letter quality mode). IBM also announced the Color Jetprinter, a $745 ink jet color printer capable of text or graphics printing on a wide variety of media. IBM emphasized that both printers are largely compatible with a wide variety of existing IBM PC software.
—*John Dickinson*

A Sporty Software Package . . . The organizing committee for the 1988 Winter Olympic Games has chosen **Project Software and Development, Inc. (PSDI)**, of Cambridge, Mass. to be its official supplier of project management software.

PSDI will provide a scheduling program, a project cost program, a graphics package, a relational database, and its *QUIKNET* integrated management program to the Winter Games committee. These products will be used in the preparation, staging, and execution of the XV Winter Olympics in Calgary, Alberta, Canada.

As yet, the organizing committee has not chosen an official supplier of hardware, but it will be using a combination of personal computers and mainframes. The organizing committee will use a large central mainframe system that can be accessed by other people involved in the Olympics. A networking system called "OCO-NET" will be established, and by 1986 the committee hopes to provide an on-line information service that will be available to the media and Olympic attendees. This information will include ticket availability, scheduling of events, and information on accommodations in the Calgary area.

Faster Than a Speeding AT . . . Although the power and speed of the IBM PC AT are attractive, you might have to wait a while to get your hands on one. In the meantime, **Phoenix Computer Products Corporation** has a way to speed up the processing power of your PC or XT without removing, replacing, or losing the 8088 CPU. Its new Pfaster286 is an 80286-based add-on board that allows an 80286 chip to function as the system CPU. It runs at a clock speed of 8 MHz—2 MHz faster than the AT's clock.

Pfaster286 uses the PC's and XT's native 8088 CPU to manage the I/O functions while in coprocessor mode. You can bypass the 80286 and switch back to the 8088 mode if your program requires it.

Phoenix Computer's president, Tom Stellinger, says that for power PC and XT users, the Pfaster286 is an ideal alternative to buying an AT. "We've developed an add-on solution that brings the full power of the 80286 chip to PCs and XTs without forcing users to give up the native 8088 processor," says Stellinger.

The Pfaster286 has 1 MB of RAM but can be expanded to 2 MB. An added option includes an 80287 floating-point processor chip especially suited for high-speed math calculations.

Pfaster286 with 1 MB of RAM costs $2,395, the 80287 floating-point chip is $350, and each additional 512K of RAM is $400. Phoenix expects delivery of Pfaster286 in July.

Further information can be obtained from Phoenix Computer Products Corp., 1420 Providence Hwy, #115, Norwood, MA 02062, (617) 762-5030.

By Any Other Name . . . MSX Corporation of Redwood City, Calif. has filed a suit in Northern California Federal District Court against **Microsoft Corporation**. MSX is seeking injunctive relief and damages from Microsoft for using the MSX trademark—a trademark that has been used by MSX Corporation for over 2 years.

MSX Corporation sells and services computers for large companies and also owns the Touch Me Computers retail chain stores located at malls in Northern California.

Monitoring the Problem . . . IBM may have discontinued production of the PCjr this spring, but the smallest PC's sales were so spectacular last fall that Big Blue was faced with another problem. Many customers had PCjrs back-ordered for more than three months, and dealers began grumbling that they were unable to get the necessary hardware from IBM. Not wanting to renege on its commitments, IBM assured waiting customers and dealers that it intended to catch up on shipments. Just to prove its sincerity, IBM offered many of its customers the more expensive color RGB display. It was quite a good deal for those who had to wait. This RGB display, designed originally for the IBM PC, sells for $680. The out-of-stock PCjr display retails for $429.

IBM's PCjr Color Display

However, if you use your PCjr mainly for game playing, you'll be disappointed by the more-expensive monitor—it does not have the three-voice sounds of the PCjr display, and it should not be placed directly on top of the PCjr.

Quadram Calling . . . Quadram Corporation has two new full-length enhancement boards that will turn the PC into an integrated voice/data communication management system. The Asher C1200 and the Asher C2400 each comes with a two-line electronic telephone with a handset, *Asher Desk Management Software*, *AsherLink* communications software, and *AsherDOS*, a concurrent windowing program. With *AsherDOS*, a user can switch between five different programs. All voice and data communications can occur simultaneously and are controlled through the PC keyboard. The Asher C1200 sells for $695 and the C2400 costs $995.

For more information about both boards, contact Quadram at 4355 International Blvd., Norcross, GA 30093 (404) 923-6666.

Cream of the Crop . . . An electronic information system for the agriculture industry is now available from **MCI Mail** and **AgriData Resources, Inc**. The new service, called MCI Mail for Agriculture, is an extension of AgriData Network—AgriData Resource's electronic information and communications system. MCI's paper mail and Telex services are the newest features of the information system. MCI Mail for Agriculture offers news, weather, prices, and advisory services to farmers and others in agribusiness. ■

Victor

intend to vigorously defend the case."

Because of a series of bad business decisions, Victor entered Chapter 11 bankruptcy in 1983. Having paid off its debts, the company is now a 90 percent owned subsidiary of Datatronic, AB., a Swedish software company. Victor's facility in Scott's Valley, California continues to operate, however some of the manufacturing functions currently handled there are scheduled to be transferred overseas.

The two PC-compatibles, the VI and the VPC, were unveiled at Spring COMDEX. Both the VI and the VPC boast such features as high-resolution screen and high-capacity floppy disk capability. In addition, the company has plans to make its transportable computer, "Vicki," now popular in Europe, available to domestic audiences.

Both machines include Victor's enhanced version of BASICA and *Victor-VU*, an on-screen guide designed to answer the questions of a first-time user. The VI base price is $3,795 ($4,995 with a 10-MB hard disk). The VPC will cost $1,995 ($3,295 with a 15-MB hard disk, $4,295 for 30-MB).

"There has never been an inexpensive Victor," says Marlow. "There has always been a sense of pride about performance. Now, it's time to announce that Victor is alive. There will always be one IBM and one Apple. That leaves room for everyone else to decide what they want."

Old Vic, New Vic

While a large number of people obviously have not yet decided on Victor, some of the machine's users are avid partisans. Its supporters call the Victor 9000 the Maytag of the PC industry, saying it almost never needs repairs.

Marlow says the Victor line is better suited for the value-added reseller, and that VARs would be responsible for a large percentage of unit sales. Selling Victors through retail channels, as well, figures to be an uphill battle in a shrinking marketplace. ■

Xerox Launches Its Office Line

BY CHARLES BERMANT

NEW YORK—Xerox insists that it is not copying anybody with its announcement of a new product line. "Our primary focus is to configure full solutions to customer needs," says Barry Nickerson, Xerox Information Systems marketing manager. "This new line now allows us to fill a customer's needs without any preconceived notions."

Nickerson says that whatever equipment is needed to run an office—from large-capacity computers to typewriters—is now available from Xerox. He adds that the company's ten new products represent the first of four "waves" of hardware and software expected in the next two years.

"We're doing as well if not better than 99 percent of the vendors as far as the depth of product line," he says. "IBM is the only other vendor with as full a range.

"They are now at a point where we were a while ago. They are suffering due to a lack of compatibility of products. It's an open race; we can coexist."

Xerox may be pointing its sights at IBM, but there are no plans to copy the product center strategy. The huge Xerox sales force has recently been consolidated in an effort to enhance the selling of specific solutions for various office problems.

Product Specific

Among the April 30 introductions is a family of personal computers that are compatible with both MS-DOS and Xerox's own network systems architecture. Xerox's *ScreenMate*, which provides a Macintosh-like language interface to simplify the DOS command set, is included with every computer. Input can come from the keyboard or from an optional mouse. The Xerox PC can be changed into a dedicated word processor through the addition

of a special keyboard and custom software. The Xerox PC is manufactured by the Olivetti corporation.

A desktop professional computer, the Xerox 6085, priced at $4,995, will be offered in network, remote, and standalone configurations. A choice of a 15- and 19-inch display, both significantly larger than a regular PC's display monitor, is also offered.

More than 20 software packages for the 6085, including graphics, spreadsheets, file conversion, and mathematic processing programs will be offered. Some other utilities include *VP Data Capture*, which can take a "snapshot" of mainframe data for manipulation on the PC, and *Extended Language Option*, which allows the composition of Japanese and Chinese documents with the QWERTY keyboard.

In addition, Xerox will market two laser printers, designed

to address the respective high and low ends of the laser printer market. The 4045 Laser CP, priced at $4,995, prints text, graphics, and data at a 10-page-per-minute rate. It can be shared by up to four PCs and can store up to 128 different fonts. The Xerox 3700, priced at $29,995, has its own 10-MB fixed disk and is obviously intended for high volume use. This printer can handle approximately 20,000 pages monthly.

In addition, Xerox has joined with AT&T in the marketing of the Starlan, Ma Bell's version of a low-cost local area network system. ■

New Scientific Branch Created by Tecmar

CLEVELAND, OH.—Over 10 years ago, a physician named Marty Alpert developed a pulmonary diagnostic instrument and digital-to-analog and analog-to-digital converter. From those early scientific beginnings, Tecmar was born. Having grown into one of the major manufacturers of peripherals and add-on hardware for the PC, the company is now reorganizing in order to once again reemphasize its scientific beginnings.

President Marty Alpert has announced that the company's scientific and industrial products will be manufactured, marketed, sold, and supported through a new, wholly-owned Tecmar subsidiary to be called Scientific Solutions, Inc. Alpert will direct the new company,

which, like Tecmar, will operate in Solon, Ohio, a suburb of Cleveland.

Scientific Solutions will take over Tecmar's current line of about 50 scientific and industrial products. These include the Lab Master Board, which converts a PC into a multifunction laboratory tool; the Lab Tender Board, a data processing subsystem for industrial, scientific, and other laboratory and control environments; and the Base Board, which supports digital input and output and lets users customize multifunction boards by adding up to four modules of their choice.

Tecmar officials said they are creating the subsidiary in order to give more focused attention and service to their line of scientific products. —*Don Kennedy*

CXI is now compatible with what's-her-name.

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It means the CXI 3278/79 PLUS coaxial connection is now 100 percent compatible with IRMA.™ So you can add our new hardware to your network and run all the same software she runs. Without changing a thing.

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Our CXI 3278/79 PLUS emulator gives you more to work with. You get one host session, one PC DOS session and two notepads. All on the same screen at the same time. No toggling back and forth between sessions. And no wasted effort whatsoever.

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Interested? For a brochure about these and other CONNECTWARE™ micro-to-mainframe solutions, call us at 800/221-6402. In California, call 415/424-0700. Or write CXI, Inc., 3606 West Bayshore Road, Palo Alto, CA 94303. We'll make you forget all about old you-know-who.

We don't have all the answers. Except for more of them.

CXI

The AT's Slipped Disk

OPINION

BY JOHN DICKINSON

It's one thing when IBM produces an uninteresting or ineffective product like the PCjr or PC Portable. That merely hurts the company's reputation as an unbeatable marketeer. It's quite another thing when IBM produces a product that is often unreliable, such as the Enhanced PC AT. That can damage its customers' business.

When IBM introduced the PC AT, the microcomputer industry was astonished by its unmatched price-performance ratio. The pricing was clearly a marketing decision aimed at quenching competitive fires before the matches were lit. IBM was trying to avoid another Compaq situation. However, it seems this pricing decision also led to the Enhanced AT's reliability problems.

The key, and most expensive, component of the Enhanced AT is its 20-MB hard disk. In order to keep costs low, IBM selected a hard disk manufactured by Computer Memories, Inc. (CMI), of Chatsworth, Calif. Rumor has it that no other vendor would meet the price/performance characteristics IBM had in mind when it designed (and priced) its flagship micro.

Whether that is true or not, the resulting problems have done little to dispel that rumor. The CMI Winchesters suffer from serious reliability problems. Worse, it's not easy to get an AT fixed when things go wrong with the disk. Believe me, I know.

Spare Parts

When my AT's CMI Winchester started to fail (data disappeared and files became unusable as disk clusters went bad) after 6 months of not-too-intensive use, I called my friendly dealer, told him the bad news, and asked if he had another Winchester in stock to replace mine. The surprise answer was, "No, IBM has never shipped us the AT Spare Parts Kit."

IBM requires all certified dealers to maintain a spare parts inventory on all machines they carry. It's scandalous that the company has ambushed its own dealers by failing to provide them with the parts they need to meet its own parts stock requirement for the AT.

I asked if a new disk could be ordered. Again, the answer was, "No, IBM wants all AT parts returned before they'll replace them." IBM is apparently so bent on using its parts inventory to produce new ATs that it only ships replacements on a trade-in basis.

I duly handed the machine to ComputerLand where the CMI disk was tested using IBM's Advanced Diagnostics (it flunked), removed, and sent to IBM's repair facility in Indiana. Three days later the replacement arrived, and I dragged the AT back to ComputerLand for

A Failing Diagnosis

It was a waste of time. This one failed IBM's Advanced Diagnostics tests the minute I fired it up. It had six bad tracks that had not been marked at the factory. It too, was removed and sent back to IBM.

The third one arrived a week later and made it through Advanced Diagnostics—well, not quite. One track turned up bad, and the technician I contacted suggested I let the diagnostics mark it and see how the disk made out.

It didn't. The next afternoon my word processor lost most of

The bottom line is that IBM is not maintaining the reputation for quality products that has made it so successful in the business world. The company is even denying AT problems.

a file trying to save it. I ran Peter Norton's *Disk Test* program, which identified 11 bad clusters. Running Advanced Diagnostics back at ComputerLand (again) showed that 17 cylinders had gone bad—after less than 6 hours of use.

There have been plenty of "authoritative" reasons given in the press about the cause of the AT's disk problems—none, of course, come from IBM. Wherever they come from, my experiences support all of the more popular theories.

Head Aches

The flawed tracks on the first disk were located on the same surface and read by the same head, lending credence to the theory that surface imperfections or head maladies were the cause of the problem. The second one failed in several places, which made the disk controller look like a likely cause of the trouble—another popular theory. When the third one was pulled out, the cables had slipped slightly on the supporting pins on the controller board, supporting the rumor that IBM's specifications for the jacks had been too generous and allowed them to wiggle off and cause problems.

After the first three disks supported every popular theory about the cause of the problem, the fourth disk got the red carpet treatment: A new controller card was installed along with it. It would have had new cables too, but none were available. (The new card does seem to hold the cables more snugly.)

So, the fourth CMI disk is now installed. So far, so good, but it's only been a couple of relatively idle weekend days since the cabinet was bolted back on the system. Believe me, I'm running *Disk Test* whenever there's spare time and constantly (automatically, in fact) backing up files onto my eternally reliable Iomega Bernoulli Box disks.

The bottom line of all this is that IBM is not maintaining the reputation for quality products that has made it so successful in the business world. The company is publicly denying that there even is a problem with the AT's Winchester disk despite numerous trouble reports in the press and at PC user group meetings across the country. Meanwhile, out of the other side of its mouth, IBM is arranging for new suppliers for AT Winchester disks. All this shuffling and hustling is being done while its AT customers' data is truly in danger of being lost forever.

If IBM can afford to salvage its marketing reputation by giving all PCjr owners new keyboards to replace the original "Chiclet" model, surely it can afford to salvage its product-quality reputation by replacing all existing AT Winchester disks with something more reliable. The company owes this to its customers and stockholders. Continued success in this market may depend on it. ■

PC Protection: Haste Makes Mace

You've shackled your computer with extra locks, chains, and electronic alarms, but you still can't sleep peacefully. Perhaps your fitful dreams have conjured up more drastic means of computer security—like a .44 caliber pistol mounted inside your office shelf, cocked, and ready to fire at a hardware thief.

Why not give your computer stronger protection without escalating to deadly force? Protect your hardware with a can of Mace. Try BurglarMist, a nontoxic, CN-type tear gas antiburglary device made by Hillcrest Sales of Drayton, S.C. When your computer is disturbed, BurglarMist fires off its 4-ounce load of irritant gas, enough to make a 16,000-cubic-foot room unbearable for 4 hours, claims Ed Romney, the company's owner.

"The CN gas won't harm anyone, but it's a shock to someone who's never felt it before," said Romney, who speaks from experience. "It's a peppery kind of thing. Several times the gas fired off in my office when I forgot to turn off the alarm. The biggest problem each time was losing half a day's work while the air cleared."

The BurglarMist is available in three models: a mechanical unit (AB 1001, $34.95) fired by a trip cord, an electric-trigger model (AB 1005, $59.95), and a time-delay electric model (AB 1006, $69.95). Either electric version of the BurglarMist computer protector can be linked to most electric alarm systems.

If you want to arm your PC with Mace protection, be advised that use of this gas is prohibited in several states and cities. It's also illegal to ship the gas through the postal service or by air, so BurglarMist orders must be handled through United Parcel Service. For more information, contact Hillcrest Sales, Box 425, Drayton, SC 29333, (803) 583-3081.

Boot up, Tune in, Log on, Drop out

We've followed the career of former LSD guru Timothy Leary ever since the days when "control" referred to substances and not computer keys. He was our "People in the News" subject last year when he announced he was launching a career as a program designer.

Now the first fruits of his labors have evidently surfaced. Dr. Leary has been conducting seminars designed, according to his press release, to "attain electronic literacy, expand consciousness, and reprogram the brain." These seminars are held in a Masonic Temple.

The latest lecture sounds impressive; it's titled "Constructing and Using the Mind Operating System, SKIPI," explained as "offering the Super Knowledge Information Processing Intelligence program as a friend-partner-coach."

Is That a Little Black Book in Your Pocket or Are You Just Glad to See Me?

Cygnet Technologies has created a new "product that will fit in a disk drive *and* your shirt pocket." Called *The Little Black Book*, it integrates a program that runs on your PC with a pocket-size, leatherette address-book cover.

At the software end, *The Little Black Book* maintains a 400-entry phone and address list, which can include comments on each client, friend, or prospect. What's the gimmick? The program is designed to print out your data in a compact format: a booklet tailored to fit into Cygnet's stylish black jacket.

What's the advantage? A bicoastal executive could print out a different book for each coast. And, whenever you add or delete names and numbers in your life, the disk saves you from facing an accumulation of whited-out corrections and crossed-out bad memories.

The Little Black Book, priced at $49.95, is the first software product to be spun off from the company's computer-telephone-software hybrid, the Cygnet CoSystem (priced from $1,495 to $1,945). The small phone-list program can be run in the background with other MS-DOS programs and used to dial numbers automatically if you have a Hayes-compatible modem or Cygnet's $69.95 dialer board.

Why not stick this data in your pocket: Cygnet Technologies Inc., 1296 Lawrence Station Road, Sunnyvale, CA 94089, (408) 734-9946. And, let's have lunch sometime. Okay?

Go Ahead—Make My Trade!

Savvy investors seem to live by the creed "nice guys finish last," and they make no bones about it. At least that's the tough image reinforced by two rather vicious names—Revenge and Shark—picked by software companies that are vying to conquer Wall Street.

Shark is the name of a "quote processing" system that offers traders real-time stock prices through their PCs. It's obvious that Walsh, Greenwood Information Systems, Inc., of New York City didn't hit on this aggressive name through some accident of acronym. The company flaunts the killer fish in ads featuring *Jaws*-style graphics and slogans like, "You tell Shark your strategy, Shark tells you when to strike."

The company even sends out its press releases with 3½-foot inflatable sharks. (One PC News reporter uses the shark to discipline her cats.)

Although Revenge Software Inc. sounds rather sinister for the name of a maker of investment programs, Herbert Mayer, vice-president of Revenge, claims that the name was drawn from an innocent proverb: "Living well is the best revenge," coined by poet and preacher George Herbert.

Even so, Mayer confessed that he hopes the name Revenge will trigger other ideas in customers' minds when they see the company's *Option Valuator* software ($145). "Most amateurs who invest in the options market don't do very

Real Quests: The Antidote for Computerization

Ever get so involved in a computer game that it seemed like the real thing? Now the top players of two games will have a chance to break away from their hum-drum desks and experience the excitement of some real-world adventures.

King's Quest, released last year on disks and cartridges for the PC and PCjr, is an impressive animated adventure game, combining graphic dexterity with narrative cleverness. Sierra On-Line continues this adventure in a new sequel, *King's*

Quest II: Romancing the Throne ($44.95).

The first player to contact Sierra On-Line after solving the game to earn the highest possible score (185 points) will be the winner of a real-life adventure. The Best Quest Competition offers a choice of thrill trips, including a spelunking expedition, river rafting, ballooning, or mountain climbing.

For more information, write to Sierra On-Line, Coarsegold, CA 93614.

Another computer game, *Golf's Best* ($49.95), is based on a real-life model—the Pinehurst No. 2 Course in North Carolina, created in 1901. The *Golf's Best* player with the best score as of May 31, 1985, will have a chance to see how the software's simulation compares with the real fairways and greens when 1 Step Software sends the winner and three

friends to the Pinehurst Hotel and Country Club for a 3-day golfing holiday.
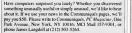
The company's second computer-golf tournament is already underway. Players of *Golf's Best* can send their top scores on diskettes to 1 Step Software, Charlotte Place #1300, Charlotte, NC 28344.

Joystick Is Optional

Relax, everybody! Artworx Software in Fairport, N.Y., has finally released what the company calls the "eagerly awaited *Strip Poker* for the IBM PC and PCjr computers . . . [In its Apple and Atari versions] this classic program has been entertaining men and women with a variety of computer opponents—each with his or her own style of play, personality, and comments."

If the prose of the press release isn't outlandish enough, you're invited to give the game a try, where you'll be playing against two female opponents. Three other data disks are available, two with more female opponents and one with men. The latter, evidently, is a kind of Poker à la Chippendale's.

The game sells for $39.95, with data disks costing $19.95. Anyone who is genuinely interested in getting naked with his or her PC can call (800) 828-6573 for more information. ■

Everything but the Kitchen Table

It's a sad fact that many computer companies go belly up even though they create fine and useful products for the personal computer consumer. How refreshing, instead, to read about a company that is still around, challenging the marketplace by making useless, defective, and disruptive hardware and software.

The history of such an innovative (albeit mythical) company, Kitchen Table Inc. (KTI), is chronicled by David D. Busch in *Sorry About the Explosion: A Humorous Guide to Computers*, published by Prentice-Hall, Englewood Cliffs, NJ 07632, with a cover price of $7.95.

The star of KTI's applications programs is *Word Whacker*, a *WordStar* workalike that even includes MicroPro's well-known copyright notice on some screens. On the lighter side, KTI ground out hundreds

of forgettable adventure games, such as *Haunted Delicatessen*, *Mood Ring*, and *Savage Bus Shop*.

KTI's contributions to systems software include *?BASIC* —an enhanced misinterpreter that incorporates the MAYBE logical operator and powerful new random commands, such as "IF . . . THEN . . . RND —if the expression is true, do something unexpected."

As a bonus, Busch's 152-page book provides PC and PCjr BASIC source code for several pieces of KTI software, including the PP/M operating system, a random sort, a random BASIC program generator, and *Mean ELIZA*, a computerized psychiatrist that automates abuse therapy. "Got any more ideas in your slimy mind?" is a typical *Mean ELIZA* input prompt.

well. We'd like people to think they can use our program to get revenge on the market for not letting them succeed in the past.''

If you'd like to take out a contract on this program, contact Revenge Software Inc., P.O. Box 1073, Huntington, NY 11743, (800) 642-9606. Or, for a taste of Shark, contact Walsh, Greenwood Information Systems Inc., 180 Maiden Lane, New York, NY 10038, (800) 431-9003. ■

DOES WORKING ON LOTUS 1-2-3 MAKE YOU SEE RED?

Granted, Lotus 1-2-3™ can be a fast spreadsheet.

Except when you first buy it, take out the five floppy disks, study the manual to figure out which ones do what, put the plastic doohickey over the keyboard, and begin reading about all the installation procedures you need to get the thing up and running.

Or if you never make a circular calculation (any simultaneous equation, even something as simple as "bonus equals 10% of profit after bonus") when doing a complicated spreadsheet.
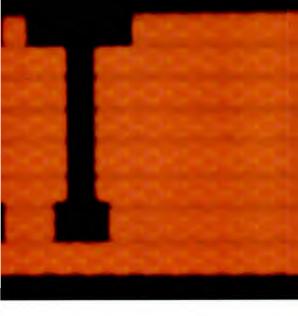
By the time 1-2-3 calculates it correctly, you may have retired.

Or if you'd like to plot your data with a single keystroke, because it can take several minutes (including a disk change) just to start the process.

Or if you'd like to quickly create a file directory under program control. 1-2-3 can't do that at all.

What's the point of all this?

We'd like you to go down to

your software dealer and see a new product called SuperCalc® 3 Release 2, which, unlike Lotus 1-2-3, does all of the above.

Along with a larger spreadsheet. Vastly superior graphics. Incredible speed (that becomes even faster when used with the 8087 or 80287 math co-processors, which 1-2-3 doesn't support). And more.

For a lot less money.

All on one disk that you can run right out of the box. (Our lawyers want you to know we include an additional file disk. Which also contains the popular printing program Sideways™, so you'll never have to cut and paste wide printed reports together again. Unless you use 1-2-3.)

But don't believe us about all this. Go take a look.

After you do, one thing should become obvious.

What are you waiting for?

SORCIM/IUS
MICRO SOFTWARE
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BEN ROSEN: Money Makes His World Go Round

BY JARED TAYLOR

In the high-flying world of venture capital, Ben Rosen is one of the highest flyers. Although he came to the venture business late in his career, he has already backed two of the fairy-tale success stories of the microcomputer era—Lotus Development Corp. and Compaq Computer—and he has his eye on still more prospects.

Constantly on the move between offices in New York, Sunnyvale, Calif., and Dallas, Rosen slowed down just long enough to talk to *PC* about his career.

Born in New Orleans in 1933, Rosen was first trained as an electrical engineer. "That was before computers," he says. "I studied conventional vacuum tube engineering." After a stint as an engineer, he went to business school and then to Wall Street as an electronics industry analyst, a move that gave him a chance to combine his interests in business and finance with his electronics background. Before long, Rosen had a loyal following and started keeping investors up-to-date on the fast-moving computer industry with the *Rosen Electronics Letter.*

Entering the Ring

Then, after 15 years as an industry-watcher, Rosen decided to jump into the ring himself. He teamed up with L. J. Sevin, the founder of Mostek, to put together a venture fund. "Our combination of his inside experience (in the electronics industry) and my outside experience were what we tried to use to offset the fact that neither of us had been in a venture capital firm," says Rosen.

The combination worked. The two men scraped together $25 million and in 1981, Sevin Rosen Management Company was born.

It wasn't long before the partners started doing things right. In March, 1982, the partnership invested in Compaq Computer and closed a deal with Lotus just one month later. The success of these two companies surprised even their backers. Compaq's

> "Success in this market is an AND gate, and there are five inputs—if you're missing a single input, no signal comes out."

founders forecasted wildly ambitious sales right from the start. "We didn't believe them," says Rosen. "Apple did $800,000 its first year and $8 million in its second year, and here Compaq was forecasting *$30 million* for its first year." Rosen pauses and smiles. "They ended up doing $111 million."

Lotus Blossom

If anything, Lotus was a bigger surprise. Its first-year sales forecast of $3 million was way off. The company did $53 million. "That's 17 times more than forecast," marvels Rosen.

Both companies caught the wave at just the right moment. As Rosen points out, when Apple and Microsoft first started, the market for micros was young. They couldn't grow any faster than the market. But by the time portable Compaqs and 1-2-3 spreadsheets went on sale, demand for personal computers was insatiable. "If you have the demand on one side and the production capability on the other,

er," says Rosen, "you can generate hundreds of millions of dollars in the first year or two."

Of course, Lotus and Compaq had more than good timing. They had all the ingredients Rosen looks for in a deal. He makes the following computer logic metaphor: "Success in this market is an AND gate, and there are five inputs—the right marketing strategy, the right product strategy, the right man-

agement, the right execution, and the right financial resources. If you're missing a single input, no signal comes out."

Stable Record

Plenty of established computer companies with far more resources than Compaq failed with their micros because they didn't have all five inputs. "They've all found ways to snatch defeat from the jaws of victory," says Rosen.

Sevin Rosen Management hasn't always scored either. The company invested in one of the computer business's best known failures: Osborne. It has also written off its funding for ComputerThought Corporation, a software company based on artificial intelligence concepts. "They were a little ahead of their time," says Rosen.

But no stable of horses can be all winners, and Rosen is busy grooming next-season champions. He argues that Compaq and Lotus were unusual, not for their success, but for how quickly they were successful.

He has invested in at least two other companies for which he promises "near-term superstar status." One, Convex Computer, makes machines that are about one-fourth the speed of a Cray supercomputer "but at one-tenth the cost and one-tenth the power consumption." Another, Cypress Semiconductor, builds CMOS chips that Rosen calls "the fastest semiconductors in the world."

Out on a Limb

Sevin Rosen Management has even gone out on a limb and invested in yet another software startup. "We didn't think we were going to do any more software investments because the noise level and cost of entry are so high," says Rosen. But he and his partners got "personally enthused" about this product—tentatively called ANSA—and took the plunge. Rosen, who has seen too many great promises dissolve into vaporware, won't talk about the new package. "We're not going to say anything until we're ready to ship," he says.

Though Rosen spends most of his time watching over the companies he has already backed (he's on the board of five of them), he is always on the prowl for a new deal. He estimates that his firm, which has now grown to six partners, will look at 1,000 deals this year. Maybe five will get the nod.

Ben Rosen is a busy man, but he likes it that way. "This is actually my fifth career," he says. "I was an engineer, a consultant, an analyst, I did the newsletter, and now I'm a venture capitalist. This is by far the most stimulating and exhilarating." ∎

DOWN TIME BY WINN L. ROSCH

Wrist Computers: Wearing Your Screen on Your Sleeve

A historical precedent, an air of inevitability, and a certain degree of hype have all contributed to our expectations of ever-smaller computers. The trend was well established by the time the room-filling Eniac shrank to the size of a desktop PC. Now, most people expect that someday they will be able to hold a complete computer, no bigger than a half-dollar, in the palms of their hands.

I could do that today if I weren't already wearing it around my wrist. Seiko—the famed watch company that also quietly dabbles in a wide range of electronic geegaws—sells a pair of wrist-worn wonders: the UC-2000 wrist information system and the RC-1000 wrist terminal. In essence, they're both computers, and one of them could realistically rate as the world's smallest PC compatible.

Small Concessions

As Seiko honestly admits, however, these digital delights don't yet rival the power of your PC, but they do act as personal terminals. Even in that role, they are one-way gates, almost what engineers might call write-only memory. Both are limited to receiving data—the RC-1000 from your PC, and the UC-2000 from its own, detached keyboard.

Besides normal electronic watch innards, each Seiko is packed with 2K of static RAM. Their LCD displays are only windows that let you peek into their data silos to keep track of important appointments, phone numbers, recipes, and rejoinders.

I suspect that Seiko knows its market and has earmarked this twosome as high-tech toys for upwardly mobile professionals who want to impress their peers. The twins may fail there because getting full propaganda value from the watches may require you to make up for their size by being overly conspicuous about your consumption. The Seiko computers are so neatly packaged as wristwatches you'll feel compelled to arise from the table in your favorite mesquite cookery and intone Tarzan-like, "Well, according to my wrist computer, I see that it's time for my next very important appointment with the chief executive officer of a major blue chip corporation." If you're not careful, someone may doubt your sincerity.

Toying with Technology

Utility aside, a close look at these timepieces reveals each to be a genuine technical tour deforce. Each watch contains a calendar, clock, support circuitry, and RAM in a space not much larger than the commer-

cial 16K CMOS BIOS chip that the Seiko's memory is equivalent to.

The RC-1000 is a well thought-out PC-compatible add-on. Plug its connector cable into your PC's serial port, run Seiko's software, and key in your favorite facts. Up to 80 24-character entries can be stored inside and displayed one at a time on its two-line, 24-character LCD readout.

The UC-2000 becomes an entire computer system—complete with Microsoft BASIC, a calculator, and a text editor—by laying it atop its pocket-computer-size keyboard-controller (model UC-2200). Without physical connection, the watch then acts as the controller's memory repository and 40-character display.

Alas, that's 40 characters total—four lines of ten columns each, not quite enough for composing your next novel. Probably to save RAM requirements, the display is character oriented rather than bit mapped. However, it's rich enough in extra symbols to make three complete alphabets of different sizes with some extra icons to spare.

Though a clever and appealing plaything, the UC-2000 system rates poorly as a computer, even compared to $100 hand-held models. It's extremely slow, and—yawn—if you thought the PCjr's keyboard was bad, Seiko's takes the big step from purgatory to hell. The

keys are too tiny to be called Chiclets and too unreliable to be called anything not profane.

Let's Get Small

However, comparing either wristband to a handheld computer is blatantly unfair. These wonderful watches are obviously not made for normal number crunching or word work. Both are special-purpose machines that flaunt just about the fatal limit of computer miniaturization—the human interface.

As machines get smaller, the problem of information transfer grows larger. You want a screen large enough to see, and a CPU large enough to really use.

Neither of these miniaturization marvels would be solved for PC-like machines until thought-waves can be directly read by a computer and images can be projected onto your retina. But this doesn't mean that there's no hope for the wrist computer.

These Seikos are but a single step from being genuinely useful. All they need is the capability to be loaded with programs instead of words. Given this, these electronic bracelets might start growing under pin-striped sleeves faster than worms under rocks.

Once such wrist computers catch on, they may start a whole new spate of miniaturization—and maybe a new trend in high-tech jewelry. Who knows what's next—earring, tie-tack, or even pinkie-ring computers.

Yet the acceptance of such new machines will bring another flurry of problems. You won't just have to worry whether your new computer is compatible with your present software, you'll have to be sure it's color coordinated with your wardrobe too. ∎

> Seiko has earmarked wrist computers as high-tech toys for upwardly mobile professionals who want to impress their peers.

Seiko UC-2000 Wrist Information System
Seiko RC-1000 Wrist Terminal
Hattori Corp. of America
Consumer Electronics Div.
1330 W. Walnut Pkwy.
Compton, CA 90220
(213) 603-9550
List Price: UC-2000 with controller and printer, $340; RC-1000, $149.
Requires: RS-232 serial port for the RC-1000.

Prime Picks of the Professional Programming Litter

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Improving the efficiency of sales work demands a fast, foolproof way to manage product and client information, and I've found one. You'll have to dig deep in your pocket, but you'll find the return worth the investment with *Accountability: Prospecting* (Key Systems, Inc., 512 Executive Park, Louisville, KY 40207; $640 plus $3.50 handling; for PCs, XTs, and compatibles; requires 128K, DOS 2.*x*).

Prospecting is a sales, marketing, and after-sales support tool, that is adaptable to any business. Specifically, it's a prospect/client database with a useful set of analytical tools. Twenty-six user-defined data fields are available for descriptive information, and nine product marketing categories yield another 63 potential fields. A powerful targeting command makes short work of finding specific records and generating reports to either screen or printer. *Prospecting* also prints personalized letters, mailing labels, and index cards.

All Purpose Calculator

Many people with computers on their desks find no room left for calculators. And some don't like the way traditional calculators make you work. They think you should be able to type $150+(TAN(45DEG)CONTROL3*(PI*17.514))/e$ and watch the answer pop up. And now you can, with the *All Purpose Calculator*.

The calculator's company, Peerless Engineering Service, calls its product a calculator for people who "think reverse-Polish notation is what Lech Walesa uses to send secret messages." Tongue-in-cheek maybe, but true because you make calculations with *All Purpose*

Key Systems's Accountability: Prospecting

Peerless Engineering's All Purpose Calculator

Calculator (up to 64 characters) much as you would speak them. A full range of trigonometric functions is available along with six constants and 20 on-screen programmable memories (Peerless Engineering Service, 5819 Soquel Dr., Soquel, CA 95073; $29.95 plus $2.50 handling; requires 64K RAM, DOS 2.*x*).

The Decision Maker

What a calculator can't help you figure out, such as filling a chair on your board of directors or choosing a distributor for your products, *The Decision Maker* can.

Basically, *The Decision Maker* asks for the pertinent information about a situation or individual, then weighs the problem for you by scoring each alternative.

The program divides your criteria into limits, on which you will not compromise, and desirables, on which you will, forcing you to assign point values and orders of importance. Then it ranks your candidates and delivers a report containing any or all sections of the decision-making process. This allows you to go back and make changes easily. *The Decision Maker* (Alamo Learning Systems, 47 Quail Court, Suite 300, Walnut Creek, CA 94596; $250 plus $2.50 handling; for PCs, XTs, and compatibles; requires 96K RAM, DOS 1.*x*) is a valuable tool, and it's not difficult to master; still, you do most of the work.

Executive Filer and Executive Writer

Executive Filer is a file manager quite different from most because it was designed to store and retrieve documents and graphics rather than data. Though it can be used alone to capture and store graphics from other programs and ASCII text from other editors, *Executive Filer* was meant to be used in conjunction with *Executive Writer*. I say that with certainty because the two programs used to be sold as a single product called *The Ideo Processor*. *Executive Filer* and *Writer* not only lack fresh design, but were not reworked enough from their unsuccessful ancestry to be worth the lower price. Both offer plenty of features and good on-line help, but the interface is clumsy and commands are difficult to remember. But beyond these complaints lies an interesting system for creating and filing documents.

Executive Writer is a full-featured word processor, modeled in many respects after dedicated Wangs. Each document is coded with up to ten keywords. So you could query *Executive Filer* for all reports about microcomputers that mention network sharing and/or multitasking that were generated by three researchers in March, and so forth. The ability to store business charts, spreadsheets, and graphics generated by other programs is the most endearing feature of the *Executive Filer* and *Executive Writer* (Paperback Software, 2612 Eighth St., Berkeley, CA 94710; $49.95 and $69.95; for PCs, XTs, ATs, PCjrs, and compatibles; requires 128K RAM, DOS 2.*x*).

Stock Record-Query-Portfolio Manager

Stock Record-Query-Portfolio Manager is a set of three powerful *1-2-3* templates (also available for *Symphony*) that record and analyze stock and bond issues. The number of issues you can track depends on memory and frequency.

The *Stock Record* program is the database of stock histories, and it provides complex analysis and graphing of stock performance. *Query* compares and sorts this data. And *Portfolio Manager* records transactions, providing detailed summaries, statistics, and tax information. It calculates commissions, return on investment, gain/loss, and interest on margin automatically. Using Lotus's *Table* function, it's a snap to model the performance of a purchase at different prices. *Stock Record-Query-Portfolio Manager* (Micro-Calculations, Box 60123, Grand Junction, CO 81501; $125 includes handling; for PCs, XTs, ATs, PCjrs, and compatibles; requires 256K, DOS 1.*x*) ends up automating much of *1-2-3*, but it requires intermediate to advanced experience with the program. ∎

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IBM's Screen Star Shines

PRODUCT REVIEW

BY DARRELL PLANK

Ever since IBM released the PC, there has been speculation about the accompanying color board that was sure to follow. After all, there was plenty of power in the new machine to handle something more exotic than the color/graphics adapter (CGA) released with the PC. At long last, IBM has announced two new color/graphics boards and accompanying high-resolution monitors. The results have been worth the wait.

One of the cards, the enhanced graphics adapter (EGA), is not as flashy as its big brother, the professional graphics adapter (PGA), but it's more upwardly compatible with previous graphics cards and easier to use for interactive graphics applications. This compatibility and flexibility, plus a much lower price tag, will make the EGA the card of choice for most users looking for higher powered graphics.

Distinct Advantages

The EGA can handle the standard IBM RGB monitor or the monochrome monitor in any of the modes currently available. Most applications will continue to run under the new cards just as they did with the old CGAs and monochrome adapters.

However, the EGA doesn't have an MC6845 chip. This chip is the workhorse of the CGA, and to maintain compatibility, the EGA has to simulate its function. The simulation is not exact though, so some graphics programs that write directly to the 6845 chip won't work on the EGA. Changes to make such programs EGA compatible should be fairly simple, so expect to see upgraded, EGA-compatible versions of these programs soon.

Added Features

While it's comforting to know that existing applications will still run on the EGA, the real promise of this card lies in

its new features. If you have an RGB monitor and are tired of the two color sets available on the standard color adapter, take heart—the EGA allows 16 colors at both 320 × 200 and 640 × 200 resolutions. The EGA also supports graphics on the monochrome monitor with a resolution of 640 × 350 and four colors. Four colors? Yes—what the rest of the world sees as blinking, intensified, black, and

normal, IBM interprets as colors. Unfortunately, the EGA is incompatible with the Hercules card, which also supports graphics on the monochrome screen. Any programs created specifically for Hercules will not run on the EGA with a monochrome monitor.

Shining in Color

Although the EGA certainly enhances a standard RGB display, it really shines with the new IBM enhanced color display, which was designed specifically for the EGA. While the extra colors on a standard display are fun to look at for a while, the same fuzzy characters that always plagued the RGB monitors can make the eyes start to water after a full day of staring at the screen. The enhanced color display takes care of all that. With a 640 × 350 resolution and an 8 × 14 character box, the letters are crisp and clear enough for even

the most discerning and sensitive eyes.

Sixteen colors can also offer a pleasing alternative to white on black. By replacing the BIOS, the EGA ensures that these characters are always used in text mode so that DOS and several text-based applications will automatically take advantage of the new sharpest text. This is a welcome improvement for those of us who appreciate color

but aren't ready to sacrifice our eyesight for it.

The EGA comes with a standard 64K of memory on board. An optional extra memory board can be piggybacked onto the EGA card, totaling up to 256K and still taking up only one slot. In most cases, this memory simply adds video pages. Typically, this does not affect the usability of the card since so few applications take advantage of pages.

The Full Spectrum

However, there is one situation in which the extra memory might be worth the additional cost. As mentioned previously, there are up to 16 colors available in the 640 × 350 graphics mode. However, if the EGA only has 64K, only 4 colors (black, red, white, and blue) are available. Additionally, certain technical limitations make it difficult to perform some screen operations quickly in this mode.

Given the choice of 640 × 350, 4-color mode, and 640 × 200, 16-color mode, some developers will be forced to choose the lower resolution. Expanding the EGA to 128K eliminates this problem and allows the full 16 colors.

Leading the Pack

Technically speaking, the EGA has some features that place it far ahead of most color cards. The EGA creates colors by writing to color planes. Color planes can be thought of as several screens superimposed

IBM's EGA handles conventional mono and color monitors, and adds a new dimension of advanced full-color features.

onto each other. Colors are created by writing different values to the different screens. Unlike many color-plane systems for which data has to be written once for each plane, the EGA can write to several planes simultaneously. Many applications run just as fast on the EGA as on the CGA, in spite of the fact that four times as much data is being written. In fact, the EGA doesn't require the processor to wait for the video to access memory; therefore, many applications will actually run faster on the EGA.

Icing on the Cake

In addition to the new modes, the EGA offers other features that are not immediately evident but will probably show up in interesting ways in future software.

Smooth scrolling, loadable character fonts (with any character box size—I have my mon-

(continued on next page)

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PC UPDATE BY VIRGINIA DUDEK

NEW YORK — Major enhancements to Lotus's two breadwinners, 1-2-3 and Symphony, have been announced. Symphony 1.1 is now available with a host of features, including an expanded memory specification that enables Symphony to recognize the presence of a memory enhancement board. (See the Lotus/Intel article this issue of PC News.) More efficient memory allocation, a macro library manager, and 8087/80287 coprocessor support have also been added. Lotus also promises a simplified installation program and new documentation.

1-2-3 makes its entrance this fall with enhancements similar to those for Symphony. Users can expect support for expanded memory specification and the 8087/80287, access to DOS, linear regression functions, and more macro commands. Both Symphony and 1-2-3 files will be compatible with each other.

Symphony upgrades are free to users who purchased the software after April 24. If purchased before April 24, upgrades are $75. 1-2-3 is also free for purchases made after April 24. Programs purchased before April 24 can be upgraded this fall. Lotus will distribute both upgrades.

* * *

MicroPROFIT Version 3.011, a financial planning and modeling system from Vim Computer, Inc. in San Diego, Calif. is now available. Some of the new features designed to automate the processing of financial models include a customized help screen and capability to memorize command sequences. The key expansion function can be programmed to automate operations performed on a regular basis. Upgrades for Version 2.01 cost $100, and include a new manual and new disks. For Version 3.01, $30 gets you new disks and supplemental pages for the current manual. Both are available from Vim.

* * *

Low-priced desktop utilities abound now that Belleoft, Inc. of Bellevue, Wash., has lowered prices on its Pop-up software. The Pop-Up DeskSet, which consists of a calendar, notepad, calculator, financial calculator, a new DOS utility called Anything, and an automatic telephone dialer, now sells for $69.95. DeskSet Plus has an additional telecommunications package and sells for $129.

* * *

Some short takes: Sysgen, Inc., of Fremont, Calif., has enhanced the Sysgen Image streaming tape subsystem. Release 3.01 supports PC-DOS 3.0 and performs image backups and file-by-file back-ups of hard disks with capacities of over 10 MB. Call Sysgen or ask your dealer for upgrades...On the safety front, Softguard Systems of Santa Clara, Calif. announced SUPERLOK 2.03. The software copy protection program now transfers protected programs between hard disks and floppy disks and between compatible hard disks. Call Softguard, (408) 970-9240, for upgrades.

Be a contributor to PC Update. Write or call Virginia Dudek, PC Magazine, One Park Avenue, NY, NY 10016 (212) 503-5265.

Screen Star (continued from preceding page)

itor set up to show 43 lines in high resolution text mode by using 8 × 8 characters), split screens, and 256 colors (only 16 on the screen at a time) are only some of the goodies available for the enterprising developer.

While the EGA is an exciting new card with a wealth of possibilities for creative developers, it does have some flaws. One of these, the presence of many write-only registers. Most of the EGA's registers cannot be read, so some tasks are very difficult. For instance, suppose a mouse driver puts a cursor on the screen. To do this, the driver must set the registers properly, write to the screen, and then rewrite the registers to . . . to what? Since the registers can't be read, the mouse cursor can't know what their original contents were unless some special allowance is made (for example, a special mouse driver).

Structural Problems

Although technically elegant, some EGAs seem structurally unsound. On some cards, a snow appears in certain colors, and I have heard of more serious problems. However, after seeing several cards installed, I have yet to see many serious problems. Perhaps some of these glitches have been worked out since the early versions of the EGA. Some of the problems I witnessed were on a prototype card, but they seem to have disappeared in retail versions.

Another minor problem is that there is no composite color output from the EGA (although there are a couple of composite

The EGA allows users to set important dip switches without removing the case.

jacks on the back mysteriously marked "reserved" in the documentation). This means that you can't run your standard color TV or composite monitor from the EGA. On the other hand, the advantages of the EGA would be lost on anything less than an RGB monitor, so this is really not much of a problem.

The EGA is an excellent addition to the IBM set of display adapters. As the new IBM standard, it's a sure bet to become the industry standard as well and inspire a large base of software to support it soon. The EGA is a welcome relief from the mediocre graphics capabilities IBM has offered so far. I think that in the months ahead, the consensus will be that the EGA is the kind of card that will make possible some of the exciting possibilities we all associate with personal computers.

Radio Active Computing

BY JAMES LANGDELL

LOS ANGELES—Somewhere between Easy Listening and FM-Rock, there is a new alternative for radio listeners here. You might not expect PCs to have much to do with such a low-tech medium as the radio, but a tasty computer-radio combo has been cooked up in Southern California at the kitchens of "The Famous Computer Cafe."

"The whole idea of our shows is to expose the human side of personal computers," said Mike Walker, who hosts "The Famous Computer Cafe" along with Ellen Lubin and Andrew Velcoff. The show's emphasis is "not so much on technical bits-and-bytes information as on the unusual and extraordinary ways people utilize this technology to do what they do. Rather than asking retailers questions, our listeners can go right to the source."

Industry figures such as IBM's Don Estridge, Microsoft's Bill Gates, and Atari's Jack Tramiel have been interviewed on the show. "The Computer Cafe" has also been visited by computer users who are celebrities in other fields. Past guests have included Herbie Hancock, Edwin Moses, Timothy Leary, Jack Anderson, Frank Herbert, Ray Bradbury, and Donny Osmond. Over 300 half-hour interviews have been broadcast on the daily show, which is heard on station KFOX

(93.5 FM) at 9 a.m. and 6 p.m. in Los Angeles.

Chip Chat

These interviews are conducted in a fictional restaurant, The Famous Computer Cafe.

Serving up digital delicacies, from the top: Andrew Velcoff, Ellen Lubin, and Mike Walker.

To make technical subjects sound less intimidating, Walker explained, "We talk about computers the way people talk about them over food." To cre-

ate a culinary ambiance, the producers occasionally use sound effects to make it seem like a waiter comes by to pour ice water and serve dishes, but the interviews are often held in restaurants. The relaxed attitude is appealing. "Listeners call up and want directions on how to drive to The Computer Cafe for dinner," he says.

"The Famous Computer Cafe" also hosts a live call-in show in Los Angeles on KIVE (870 AM) at 3:30 p.m. Callers can pose technical questions to Dr. Disk, a fictional expert with a gentle bedside manner. "Whenever he gets too technical, there's a Techno-Alert," Walker said. "A horn beeps, warning Dr. Disk to back off a little and explain what a megabyte is."

Table Talk

The Gamemaster is another personality that dines at The Computer Cafe. "He's more intense—totally into computer games," explained Walker.

"Listening to him talk is like hearing about a foreign land."

To keep the show light and lively "The Cafe's" hosts give away prizes of software and hardware and break up the talk with interludes of popular music. "No heavy rock," said Walker. "The music's designed for a Yuppie crowd. Some listeners call up just to ask, 'What was that song you just played?'"

The newest branch of "The Famous Computer Cafe" is heard nationally on the National Public Radio network. It's a weekly magazine-style program, mixing interviews, product reviews, and feature stories in each half-hour. To find out if you're within earshot of "The Famous Computer Cafe," contact SOFTV, Inc. 1322 Second St. #24, Santa Monica, CA 90401, (213) 394-7242.

Morrow's Little Maroon Maxims

Now that the Peoples Republic of China has turned away from the Cultural Revolution and bought into capitalism, it might be seeking a replacement for *Quotations from Choirman Mao*—a guide-to-life once as ubiquitous in China as Gideons Bibles are here. If so, the new regime should check out a capitalist version of a "Little Red Book," *Quotations from Chairman Morrow*, written by George Morrow, the eponymous head of Morrow Computers. His giveaway tome was the talk of the Fall COMDEX, and we at *PC Magazine* think it's still good reading now.

Here are some sample bits of Morrow's micro wisdom:

- "Not everybody needs a computer. If a dealer sells one of my computers to the wrong person, my reputation and the dealer's are on the line. Only two groups benefit—the phone company and United Parcel Service."

- "The user world would be better served if it could run software without hardware."

—*James Langdell*

At two o'clock in the morning, when most of the country's asleep, and the phone rates have gone down, my computer is talking to our offices all over the country ... all by itself.

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It does all that without anyone here to help it. I just make up a list of things for it to do, and go home. Transporter does all the rest. It "wakes up" at the appropriate time, dials up other CROSSTALK or TRANSPORTER systems, and transfers the files I want. It can even dial up a remote printer, and print files for me. And it does it all with complete accuracy. When I come in the next morning, Transporter gives me a report of what it did, and at what time it did it.

I like it because it frees up my time during the day. The boss likes it because it saves on our phone bill. (The cleaning ladies are still trying to figure it out.)

Transporter — an exciting new idea in microcomputer communications from Microstuf, the creators of CROSSTALK. Ask your local dealer about it.

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TRANSPORTER ™

CIRCLE 333 ON READER SERVICE CARD

PARITY CHECK BY STEPHEN MANES

PC-DOS: Up a Tree and Following the Wrong Path

A>

Great! No clue about what to do next. No sissy on-line help. No menu either: You can ask for any dish your heart desires. If the chef's never heard of it, you get a "Bad command or file name" raspberry.

That's one tough user interface. And it's the only one you get with the program that, at this very moment, is running on more IBM PCs than any other: PC-DOS.

How can this be? There are now enough user-interface studies to fill a 20-MB hard disk. Sure, solid conclusions are scarce: Researchers with fancy degrees still hotly debate overlapping versus tiled windows, multiple- versus single-button mice, text versus icons, color versus monochrome, pull-down versus drop-down menus, and apples versus oranges. The good old A> prompt offers none of the above; it's positively astounding that it's stuck around this long.

Ever since the earliest DOS release, rumormongers have insisted the next version of DOS would include a fancy menu-driven "visual shell." Nobody believed the unblinking, uninviting DOS prompt would survive yet another revision. But it's back once again in DOS 3.1, and by now, hardly anybody even bothers to complain. After all, millions of users manage to get along with DOS every day. So maybe this horrendous "command-driven" approach isn't so terrible after all.

No Picnic

Well, yes and no. Learning DOS is no picnic. Dealers still get angry calls from new users who turn on their machines and can't get past the "Enter new date:" prompt because they try, reasonably enough, to age the display and include the day of the week in their input. What happens when novices try to master subdirectories is too gruesome to contemplate.

Even advanced DOS users are often woefully ignorant of its subtleties. They may understand the difference between COPY and DISKCOPY but have no idea how SYS works. They may know how to change subdirectories but not how to

get the PROMPT command to display the current one. They may know how to use CHKDSK but not how to use the /F parameter to make the command actually fix bad clusters instead of just pretend. And handy undocumented tricks like running CHKDSK by typing CHECK or just the letter C (just rename the file CHECK.COM or C.COM) are unknown to all but DOS magicians.

Further Puzzlement

Every time DOS gets updated, it offers more useful tools for programmer types and more confusion for "the rest of us." Just when you've mastered all the arcane virgule (/) options, along come more with the added bonus of subdirectories and backslashes (\) to make your days rich and full. For further puzzlement, you get a rudimentary programming language for batch files and sundry piping and redirection commands—all useful, all a pain to remember, and all so poorly

documented that you can only learn how they work by laborious trial and error.

Not once has a DOS upgrade made things an iota more friendly for most users. Independent programmers have had to develop all sorts of handy utilities in the name of self-preservation. Menu-driven shells let you scroll through the current directory and highlight the file or files you want to work with. Editing programs remember previous DOS commands and

> DOS was originally developed from a quick-and-dirty operating system designed to bring 8-bit CP/M into the 16-bit world.

let you modify them in a flash. PATH extenders make the PATH command work with nonexecutable files. Directory utilities let you sort directories in just about any conceivable way. But most users don't even know these programs exist, let alone where to find them.

IBM, for example, sells such utilities for $19.95 a pop through its mail-order-only Personally Developed Software channel. But when DOS itself costs all of $60, will you really pay $20 more for some marginal improvement that may not work with all your other software and worse, comes with on-disk documentation that informs you: "When calling RETRIEVE to install itself from a batch file, be sure there are no commands that use DOS call hex 0A in the batch file following the RE-TRIEVE call"? Me, neither.

The boom in DOS utilities has mostly been in the freebie world of public-domain software available from bulletin

boards and user groups. Many of these programs are fine on their own, but the memory-resident ones can play havoc with the likes of ProKey, Sidekick, and even with each other. Mor-al: Talk to somebody who's actually used one of these programs before allowing it to scramble every file on your hard disk.

Stuck with the Rudiments

I'm not necessarily against DOS's command-line approach; for one thing, it keeps the overhead low. A menu-driven shell, like the popular 1dir, for example, takes another 15K of RAM, and its 30 help screens hog an additional 57K of disk space. You might well be better off with an operating system that's lean and mean and fast and flexible enough to accommodate a menu approach if you prefer it. But by now, DOS itself ought to include a defeatable "official" menu shell and help system. And it could certainly offer a lot more functionality for very little internal overhead.

DOS was originally developed in a hurry from a quick-and-dirty operating system designed to bring most of 8-bit CP/M into the 16-bit world. Yet many utilities built into CP/M still aren't included with DOS. And after nearly 4 years, it's ridiculous to be stuck with DOS's rudimentary editing functions, inflexible directory displays, and limited utilities. As the current standard in operating systems, DOS should at the very least include the additional functions sharp programmers have managed to develop on their own. Otherwise, today's de facto standard might become tomorrow's de facto CP/M. ■

A shelf loaded with software is impressive, but

one simple program loaded with capabilities is better.

PRINTWORKS

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To get a lot out of your printer, you need a lot of programs, right?

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New Life for the 8088

New coprocessors will add specialized functions like memory management, bank switching, I/O processing, and networking capability to extend the architecture—and the life—of the 8088.

Six months ago, the PC AT signed a death warrant for any computer that still used an 8088 chip. Or so I thought. Now it seems that the 8088 has gained a new lease on life from none other than Intel. Given the bright prospects for the 80286 in the AT and other machines, continuing the 8088 might look like the height of foolishness. Actually, it's the height of market responsiveness.

The single strongest argument for the continuation of the 8088 is the new crop of memory management cards that take the PC well beyond its 1-megabyte limit. Although Intel's MMU chip is not the only solution, it has been the guiding force for much of the market.

Processor speed is not a real issue either. Over the years, I've had some 8088- and 8086-based systems with hyperthyroid clock rates that will still walk away from a stock PC AT.

The current crop of accelerator cards shows that users are no longer afraid to yank the stock 8088 and stick in a ribbon cable leading to a faster processor. Admittedly, these cards are largely targeted at the existing 3 million PCs currently on the market. But they also give manufacturers an excuse to continue building low-performance PCs.

The New Coprocessors

The emergent subtheme of this market is coprocessing. The main message (MMU) chips are really coprocessors. This year is also seeing the greening of the 8087, the original coprocessor. More programs use it if you have it, and you can buy a card that intercepts 1-2-3's normal math routines and substitutes 8087 calls. All the spreadsheet jocks who bought a PC AT so they could have the answer to their financial models before lunch instead

Bill Machrone

of after could have saved their money. A board like this runs circles around an AT.

A coprocessor extends the effective architecture or instruction set of its host in some way—adding high-precision math or more addressing capability than its designers built in. The basic technique an MMU uses is bank switching, which alternates among 64K pages of memory. The 8086/8088 architecture makes this route particularly easy. Many of the variations on the theme go beyond some of bank switching's inherent limitations. For example, a context-switching scheme may swap in half a megabyte of memory instead of a mere 64K.

True memory management goes beyond either technique by building memory segments of arbitrary size from a pool of available memory, usually in 4K chunks. This approach has been proven on countless minicomputers and mainframes.

You Haven't Seen Anything Yet

Math and memory coprocessing are swell, but the chip designers have yet to roll out their best stuff. I've mentioned Intel's strides in producing highly integrated networking chips. Only the few that allow a host to hand off tasks to the network board can accurately be called coprocessors. These chips are now small enough and cheap enough to fit every personal computer with a network port. Right now the high cost of networking boards and lack of standards prevent them from becoming highly integrated into the host processor's activities. Higher-scale integration and lower costs will change this picture; so will I/O coprocessing.

I/O Coprocessing

Input/output processing is one of the most tedious things that a computer can do. More CPU cycles have been wasted waiting for something to happen than in actually doing useful computing. Basically there are only two ways to do I/O: looping on a port or responding to an interrupt. In the first case, software performs the same loop over and over, waiting for something to happen—a keypress, a sector from the disk controller,

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or a character from the modem.

Interrupts—the second method—are considerably more sophisticated. You set up a series of actions for the processor to take. It can then forget about them un-til they actually happen. The external event interrupts whatever the processor is working on. The host jumps to the proper routine to handle the interrupt, then resumes its prior task. The trouble

is, many of today's programs just sit there, waiting for interrupts, so you're no better off than with looping.

I/O coprocessing has the potential to take the host processor out of the loop entirely. It has worked for mainframes, and so it'll work for personal computers. If you've ever wondered what a mainframe's channel controller was, it's nothing more than an I/O coprocessor. It has its own memory, its own instruction set, and it never gets bored talking to I/O devices. It also can transfer data to and from the host at speeds upwards of a megabyte per second.

While you may not think you need that kind of performance, the difference is only in scale. Instead of hundreds of terminals or dozens of disk drives, the future personal computer will talk to all of the usual external devices and ports through an I/O controller. Your print spooling will be done by dedicated hardware instead of software that encroaches on your available memory.

Chances are good to excellent that many of the functions performed "longhand" by today's communications programs will be handled by the I/O processor. AT&T's new modem card is a harbinger of this future. It has an onboard microprocessor that frees the computer from the details of handling the phone. It can answer the phone, place calls, and otherwise manage the connection. It only interrupts the processor when it's necessary to transfer some data or get more instructions.

What to do next is not a problem that this industry has. The abundant, fertile imagination of the hardware designers is creating a gigantic "in" box for the software architects. There's a host of specialized chips such as database processors and associative memory devices yet to be perfected, string-processing equivalents of the 8087, integrated voice I/O devices, and more.

The computer you are using now is obsolete. So is mine. Unlike the planned obsolescence built into automobiles 20 years ago, our computers' obsolescence is good for more than just the smokestack economy. Each new improvement extends our reach. The design of the personal computer will never be finished. ∎

Letters to PC

I read Kenneth Friedman's business column with great interest ("Banking on Your Computer," *PC*, Volume 4 Number 10). He addresses the subject accurately and comprehensively. The article is a very good review of the near-term future of computer-based banking. I thank you for sparing *PC*'s readers some of the murky banking terminology and for writing directly to the consumer and the small businessperson.

However, I would like to correct one point—the reference to my other plans involving a joint AT&T/Chemical Bank videotex venture. At no time during my conversation with Friedman did I mention any such venture, although the February 5, 1985, issue of the *New York Times* did report rumors of related discussions between AT&T, Chemical Bank, and others.

Thanks for a fine overview of electronic banking.

Charles S. Forbes
Chemical Bank
New York, New York

Script/PC Compatibility

Dean Hannotte's review of text editors has some factual errors, and he completely misses the boat as far as *Script/PC* is concerned ("Put Your Text in Top Form," *PC*, Volume 4 Number 6).

I was amazed that he panned the program for being compatible with *Script/VS*. As clearly stated in the program documentation, *Script/PC* retains all the *Script/VS* control words because it is intended to be a subset of *Script/VS*. It fills a specific need for those of us who regularly upload and download *Script/VS* files. A package modeled on the "senile parent" is essential.

As in *Script/VS*, the despised *Script/VS* control words are in *Script/PC* the building blocks for GML macros tags and can be used to create powerful custom macros. The program includes a file with definitions of the GML starter set tags along with a description of how to modify them and/or create your own using the .DM control word. *Script/PC* supports conditional processing using IF, THEN, ELSE, AND, OR, and GOTO logical operators together with test parameters, such as EQ or GT, to allow considerable

flexibility in formatting text and a straightforward simple macro language. Some of the items on Hannotte's wishlist for the next generation of formatters for the PC are already supported by the program.

If Hannotte had read the documentation, he would have seen that "see" and "see also" index entries are indeed supported using the :IREF tag in conjunction with the delimiters REFID and SEEID and that multiline highlighted headers and footers are available. The program also offers some other goodies to do multiple columns for indexing, support variables via the .SE or .RV control words, and do multiple column balancing.

Hannotte's other criticism of *Script/PC* is also wrong. The two-pass option for the table of contents is completely op-

tional and can be used at the end of a document to support one-pass processing. Perhaps the confusion arises because the documentation states that the :TOC tag must be used only in the document front matter. Not only can the :TOC tag be used anywhere in the document, but a .TC control word allows some customization of the table of contents. If Hannotte's benchmark was rerun with the one-pass option, I think *Script/PC*'s times would look more respectable and would beat the pants off the others.

I agree that the printer support is limited, and I hope that future releases will rectify this omission. However, if you know the printer control codes and judiciously use the .TR translate command, you can customize *Script/PC* to most printers. For example, I can print boxes on my nonographics Epson and trigger the various color combinations on my color printer by using a simple translate sequence. Characters inserted into the text are translated to the appropriate output printer control codes.

I use *Script/PC* on my PC and my 3270 PC, and my wishlist includes both printer support and more raw processing speed. I agree with Hannotte's comment that anyone who needs *Script/PC* compatibility would be foolish not to buy the PC.

D. E. Malone
Scarborough, Ontario

Dean Hannotte replies:

I sympathize with Malone's need for strict Script/VS compatibility because it bars him from using the more powerful products now available for the PC. However, he shouldn't expect the rest of us to rally around an inept implementation of obsolete technology.

His happy discovery that the two-pass requirement for TOCs is merely a documentation error will be of no consolation to disgruntled Script/PC purchasers who can't share his knowledge. Even though they've paid $295 for that great IBM

LETTERS TO PC

"support," IBM hasn't bothered to notify them of this problem, much less replace the erroneous pages in the manual.

But the PDC goof pales in comparison to the footnote blunder, which requires you to tell Script/PC how many lines are at the bottom of the page to reserve for each footnote. This is something a computer is supposed to do, and the requisite code won't even amount to 20 lines.

I didn't mean to imply that Script/PC doesn't support "see" or "see also" index entries. On the other hand, the documentation does not even mention those terms. It says only that "The Index Entry Reference [i.e., :IREF] tag creates or modifies an index entry. It can be used to provide a reference to another index [sic]." If you're already a DCF droid, this might be adequate, but what about us humans? Since the documentation doesn't give any example of the output of the :IREF tag, most users will never figure out what it does and will simply hope they never have to use it.

Malone is a sophisticated user who has found a clever way to jury-rig printer support into Script/PC. But his use of .TR removes useful characters from the character set and introduces printer dependencies into what should be a high-level source. In fact, some printer attributes—such as underlining—must be turned off at the end of each line and turned on again at the start of the next, and the only way to achieve this in Script/PC is by disabling paragraph formatting. When you have to turn off formatting to get your text formatter to work, it's time to seriously consider a Macintosh.

Script/PC is almost 2 years old. Any reasonable company would have fixed the program by now, but IBM has never even released the enhanced (and debugged) version of its once prominent Personal Editor, allowing KEDIT and other products to leave it trailing in the dust. So I wouldn't hold your breath about IBM providing any real printer support in the foreseeable future.

Incidentally, another product Script fans should consider besides Readi-Writer and MicroScript is the recently released WATCOM GML, which supports the Starter Set of DCF Version 2 and includes actual printer support.

LETTERS TO PC

Battery Blues

Tyler C. Folsom's article "Is It Cheaper in Hong Kong?" (*PC*, Volume 4 Number 7) contained a common misconception about lithium batteries. Unlike nickel cadmium batteries, the lithium batteries used on clock/calendar boards are not rechargeable. While it is true that the lithium battery is not drained while the computer is on, it is not recharged. Therefore, I am puzzled by Folsom's comment that "the battery runs down and the time doesn't advance." I suspect that his clock/calendar board may be de-

Is It Cheaper in Hong Kong?

fective if his lithium battery does not maintain the time for at least a year.

My experience with several clock/calendar boards indicates that your readers will need to replace the lithium battery every 1 to 2 years, depending on how long the computer is left on.

Barry N. Nelson
Philadelphia, Pennsylvania

Praise for Holzner

I'd like to tell you how much I enjoy reading *PC* every 2 weeks and how helpful it is to me, my work, and my enjoyment of the marvels of the IBM PC.

I especially enjoy the programs that are written by Steven Holzner. For those of us who are not professional or even amateur programmers, it is wonderful to be able to construct an occasional utility or device that can enhance the use of

PC. Holzner's programs are ideal for that purpose, and I hope you continue to carry them.

I also must tell you how much I appreciated your boosts for *XyWrite*. As one of the early purchasers, I have become a zealot in proselytizing others to do likewise. I understand *XyWrite III* will be out sometime this spring, and I hope you are able to give it an equally favorable review because your imprimatur has helped me persuade skeptics of the virtues of that fine program.

Lincoln P. Bloomfield
Cambridge, Massachusetts

Saving Bookshelf Space

Congratulations on a wonderful, informative magazine. *PC* has helped educate me and turn me into a consultant. I want to keep all my back issues of *PC* for future reference but unfortunately I am running out of bookshelf space. Is *PC* available on microfiche?

Carol G. Sink
Silver Spring, Maryland

The editors at PC understand your predicament, and you're in luck. PC is available on microfiche from Belt and Howell, Old Mansfield Rd., Wooster, OH 44691, (800) 321-9881. Microfiche editions are issued quarterly and cost $31 per year for 1983 and 1984 issues of PC and $29.50 per year for 1985 issues.—Ed.

Correction:

The correct price of Tecmar's QIC/60H external 60-megabyte tape drive with controller is $2,144 (see PC News, "Will IBM Fill Gap?" *PC*, Volume 4 Number 9).

How to Write to PC

Do you have a comment, compliment, or criticism about something you've read in *PC*? A question you'd like to open up to other readers? Send it to Letters to PC, *PC Magazine*, One Park Avenue, New York, NY 10016. We are not able to answer letters personally.

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Reaching the 32-Megabyte Barrier

The cause of DOS's 32-megabyte disk storage space barrier
is hard to pinpoint, but a careful look at the mechanics of disk formatting
reveals the source of the problem.

In some ways, the 32-megabyte disk storage barrier resembles the speed of light. It takes a rather sophisticated analysis to show why either one really is a barrier. And, just as many advanced physics concepts are tied to the idea that the speed of light is the maximum attainable velocity, many intriguing side-issues and topics concerning disk storage are related to the 32-megabyte disk barrier. Last issue (see "The Gang of Fourteen: Disk Types for the AT" *PC*, Volume 4 Number 12) we discussed available disks for the AT and the difference between physical and logical hard disk formatting. This time we'll take a look at the reasons behind the 32-megabyte barrier.

Although the difference is more or less invisible to the eye, the DOS FORMAT command does not work at all the same way on floppy diskettes and fixed hard disks. When we format a diskette, the FORMAT command does what I call physical formatting, establishing the size and number of the sectors that hold disk data. Then the logical formatting, which sets up DOS's road-map for the disk, is done. With a hard disk, it's quite different. The DOS FORMAT command only does logical formatting because the physical formatting is already done—that's another thing that's fixed about a fixed disk.

No Equipment Needed

The physical formatting of a hard disk doesn't require special equipment—it can be done by a program, just as it is for a floppy diskette. (It does require some special commands to physically format a disk, while logical formatting uses ordinary read-write commands.) IBM doesn't put a physical formatting program in everybody's hands, but you can get one. It's part of IBM's Advanced Diagnostics disk, and every authorized PC dealer has it. Many dealers will lend it to you, or you can buy it

Peter Norton

as part of the admittedly expensive Advanced Diagnostics package.

Normally, we aren't ever want to redo the physical formatting of our hard disks, and, in fact, reformatting is potentially very dangerous. Unlike the regular DOS programs FDISK, FORMAT, and DEBUG, the physical formatting program will wipe away any partitions on the hard disk, besides the normal DOS partitions. However, if your hard disk has been damaged, redoing the physical formatting may restore proper operation.

The physical formatting of a disk establishes the size of the sectors that are on the disk, the number of sectors on each track,

and so forth. The physical formatting also writes onto the disk some information that we never see—special address marks that the disk circuitry uses to identify each sector on the disk. Later, when ordinary read and write operations are done on the disk, the disk's controlling circuitry uses these address marks to help make sure that the right locations on the disk are being used.

While we, and our programs, usually view disks in terms of the files stored on them, our computers' systems software sees disks in terms of sectors. There are two distinct ways of looking at sectors; DOS has one, and BIOS has another.

The BIOS, as you probably know, is the computer's most intimate set of software. It directly controls the computer's hardware, dealing with the messiest details of the commands that make the hardware work, and coping with any problems, such as hardware failure or simple balkiness. Disks, for example, don't always work on the first try. The BIOS sometimes has to coax and threaten the disk, as if it were a stubborn mule.

Three-Dimensional

As the BIOS sees things, a disk is a three-dimensional collection of sectors. Each sector of data on the disk is located by three numbers denoting the cylinder, head, and record positions. The cylinder (or track) location indicates the sector's concentric circle, from outermost to innermost; the head (or side) location indicates its disk surface; and finally, the record (or sector) number indicates where it falls among the sectors at that cylinder and side location. The terminology for these coor-

dinates can get confusing, particularly since several terms are used interchangeably: cylinder and track, side and head, sector and record. But, no matter which words we use, we're talking about three dimensions that uniquely identify and locate each sector of data.

In last issue's column, we discussed how the size of a disk can be described in four-dimensional terms: the three dimensions that locate each sector, plus the fourth dimension that indicates how big each sector is. We multiply the number of cylinders, heads, and records to get the total number of sectors. Then we multiply that times the number of bytes per sector, and we get the total size of the disk.

To get a more concrete feel for these dimensions, let's chug through two common examples. First, consider the PC's lowest common denominator, the single-sided, 8-sector diskette. These diskettes have 40 tracks (cylinders) that use only one side; on each track, there are eight sectors, so we multiply 40 times 1 times 8 to get 320 sectors. Each sector is 512 bytes, so the disk's raw capacity is 163,840 bytes. To translate that capacity into kilobytes we can divide 163,840 by 1,024, but there is a simpler way to figure the K capacity. Each 512-byte sector equals $\frac{1}{2}$K; so if we halve the number of sectors, in this case 320, we get 160, the capacity in K.

Other diskette formats have different dimensions, but the 512-byte sector size is a constant. There are, as we know, single- and double-sided diskettes. Quad-density diskettes can have 80 tracks instead of 40, the AT's high-capacity diskettes also have 80 tracks. Finally the number of sectors per track can be 8 (for DOS 1.x formats), 9 (for DOS 2.x and 3.x formats), or 17 (for the AT's high-capacity diskettes).

Consider the standard hard disk used in the PC-XT. It has 305 cylinders and four sides (both sides of two disk platters), each track circle has 17 sectors, the same number that are squeezed into the AT's high-capacity disk. These statistics multiply 20,740 sectors, a capacity of 10,370K or about 10 megabytes.

The Layered Look

The dimensional view of the disk taken by the BIOS, which expects to receive the cylinder, head, and record numbers for each disk command, offers a very low-level perspective. Properly designed computer software is built in layers that reflect increasingly abstract ideas. The BIOS-level view closely matches the physical reality of the disk, but higher layers move away from the concrete to a more abstract view of the disk, such as that taken by the disk operating system.

Quite sensibly, DOS does not see the

storage space on a disk as multidimensional. DOS does not need to "see" a disk's space as multidimensional, but rather as a large pool of space that must be managed easily and efficiently. DOS sees a disk (or hard disk partition) "flattened" into a single dimension: a single linear array of disk sectors that stretches from the first to the last. For identification and reference, the sectors are numbered, starting with zero. A single-sided 8-sector diskette has 320 sectors, numbered 0 through 319. The PC uses a simple algebraic formula that relates the sector numbers that DOS uses to the three-dimensional identifications that the BIOS uses. The software interface be-

> DOS does not see the storage space on a disk as multidimensional. It sees a disk "flattened" into a single dimension: a linear array of disk sectors stretching from the first to the last.

tween DOS and the BIOS translates a DOS reference to the last sector on a diskette as number 319 into track 39, side 0, sector 8 for the BIOS.

A Nub

This discussion brings us to one of the nubs of the matter. DOS does all of its internal recordkeeping about sectors in sequential sector numbers. The natural way to record these sector numbers is in the form of 16-bit integers, since that is the easiest and most straightforward way for the PC's 8088 microprocessor to handle numbers.

The problem is that 16-bit integers don't really have a wide range of values. If we don't need to work with negative numbers (in this case we don't), the 16-bit integer format will allow us to work with sector numbers from 0 through 65,535—a 64K range of numbers. If DOS can only keep track of 64K of sectors, then it can't cope with any disk that has more than that.

Now 65,536 sectors are a lot—but still,

a limit is a limit. With a limit of 64K sectors of ½K bytes each, DOS can't handle more than 32 megabytes. And that, very simply, is the source of the 32-megabyte barrier in the size of a DOS disk.

Well, we've found our barrier—the 32-megabyte wall. In the next issue we'll look at some more ramifications of the 32-megabyte barrier and see some of the ways that we can try to crack it. ∎

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The
Enhanced
AT A

PERSONAL
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IBM didn't include everything
you might want to make its AT a
true dream machine. So, with a little
help from third-party vendors,
one user configured his own
ultimate AT.

A PERSONAL VISION

O n the 14th of August last year in Dallas, Texas, IBM took the wraps off its PC AT, and the micro market hasn't been the same since. As newspapers and magazines digested the machine's features, they expressed admiration in a fusillade of glowing adjectives—"impressive," "powerful," "dazzling"—declaring their respect for what seemed to be the most advanced PC yet, especially in its awesome speed and power.

Built around Intel's 16-bit 80286 microprocessor, the AT's ability to perform two to three times faster than the PC impressed all who saw it.

But then the list of not-so-special features began to accumulate. Some noted that the keyboard, slightly larger than the PC-XT's, was not as good as it might have been. DOS 3.0, rushed to market before the promised IBM Local Area Network books were in place, also proved to have notable defects, some later acknowledged by its author, Microsoft. Backup woes proved twice as woeful as they'd been with the XT. Moreover, several of IBM's older 8-bit add-ons, including its asynchronous communications adapter and parallel printer adapter, didn't work at all in the new 16-bit environment.

The hard disk and floppy drives introduced with the AT were especially disappointing. By early 1985, problems with the 20-megabyte hard disk for the enhanced version would hold up AT production for several months. Even the high-density 1.2-megabyte floppy drive appeared, in the words of *PC* executive editor Paul Somerson, to "add a whole new dimension to micro incompatibility."

To complicate matters further, as the fine print in IBM's own publications warned, regular density diskettes formatted on the AT might not be usable in older IBM micros.

Yet through it all there remained one ray of hope: IBM had designed almost every one of the AT's optional features to be user-installable. So, if Big Blue wasn't going to resolve the AT's problems, third-party firms could be expected to fill the gap. All the AT user had to do was wait, and American ingenuity would save the day.

And indeed this has come to pass. Today you can have your AT without having to eat it too. Fortified with third-party products, IBM's creation can do far more than the boys in Boca Raton ever planned.

Since the AT's introduction, nimble, independent minds have been working night and day to boost the number of available AT options in six important areas: graphics adapter boards; multifunction and memory expansion cards; data storage devices; floppy disk drives and backup; utility software; and communications, multiuser, and multitasking products. AT

add-ons in these categories are examined below. There's no guarantee that your area of interest has been addressed, but rest assured that the products discussed are worth serious consideration.

It is to those with true grit, who have held out for a better AT, that the following pages are dedicated.

Monochrome and Color Graphics Adapters

Y ou look at an AT in the store and like what you see. But as soon as you decide to stop looking and start buying, you're confronted with another double-barreled decision—which display options should you choose? Big Blue offers three for the AT: the IBM monochrome adapter and its associated 12-inch monitor; the IBM Color/Graphics Adapter with a medium-resolution, 16-color, 13-inch RGB monitor; and IBM's high-resolution adapter and companion monitor, which is not really a viable configuration since it's incompatible with most existing software.

To color or not to color, that is the question. Even if you work with graphics, you may find it easier and less eye-fatiguing to use a monochrome monitor and settle for seeing actual colors only on the hard copy. Many application packages can display colors as different shades or patterns in monochrome, and monochrome monitors often produce a much clearer image than the more expensive color units.

If you go the color route, you must then decide between a composite video monitor (not among IBM's offerings) and a more expensive RGB monitor. Since the color—or red, green, or blue—of each pixel is separately determined in an RGB monitor, its display is significantly better than that of a composite video monitor, which decodes all three colors together, much like a home television does.

The typical RGB monitor is also capable of much higher resolution (the number of pixels that can be expressed horizontally and vertically) than composite video. The higher the resolution of an RGB monitor,

the more crisp and accurate the resulting graphics will be—something to consider if you expect to throw a lot of curves (graphically speaking) into your work.

In the final analysis, though, the display capability of any monitor depends on the color/graphics adapter used with it. In particular, the adapter must have sufficient on-board RAM to store the screen being displayed, and the more colors, the more memory needed per pixel. The IBM Color Adapter has a maximum resolution of 640 × 200 pixels, but when used in conjunction with the IBM Color/Graphics Adapter (which has but 16K of graphics memory) it can display only 4 colors at a time, with a resolution of no more than 320 × 200 pixels. Clearly, if you're into graphics, the IBM card is not the way to go.

The Everex Solution

If you don't want to burn any bridges when it comes to the monitor(s) you can use with your AT, you'll need a graphics adapter that's flexible enough to handle all the monitor options. And, if you're looking for optimum flexibility on a single expansion card, consider the Graphics Edge board from Everex Systems.

The technical details on the Graphics Edge board are impressive. The board comes with enough graphics memory (64K) to support either a 16-color display with 640 × 200 resolution, or a 720 × 348 screen in monochrome—an excellent spec for word processing and spreadsheet work. All three kinds of monitors can be attached to it—there are connections for composite video, IBM monochrome, and RGB. Other extras are a Centronics parallel printer port, a light-pen interface, and software utilities including RAMdisk and print spooler. All this can be had for a list price of $499.

The Graphics Edge board is quick and simple to install. The well-illustrated manual guides you through the DIP switch settings that determine the defaults for the monitors and display configurations. Programming tips and sample BASIC programs that exercise the board's 16-color high-resolution display capability are included, along with the assembly language source code for the screen mode utilities, which are

Today you can have your AT without having to eat it too. Fortified with third-party products, IBM's creation can do far more than the boys in Boca Raton ever planned.

provided for you on disk.

Actually, I've saved the best for last. Going beyond the standard IBM 80-column by 25-row display, the Graphics Edge can support what Everex calls "extended display modes." The two formats available (in monochrome only) are 132 columns by 44 rows and 132 columns by 25 rows. This feature, when used with a user-configurable word processor such as WordStar, makes it possible to view nearly an entire page of a document on screen prior to dumping it to printer. This extended display will prove particularly advanta-

geous for spreadsheet work, and the 1-2-3 driver and patch from Everex produce a very clear spreadsheet display on high-resolution monochrome monitors.

Note finally that the Graphics Edge will run all IBM color/graphics software on IBM's own monochrome monitor. That should be enough to make some AT users opt for Everex forever.

Graphics Q&A

How much resolution is enough? IBM's ultra high-resolution boards and monitors certainly look nice, but the ultra-high bucks that go with them aren't so nice, especially if it turns out that you don't really need super high-resolution color graphics. Tseng Laboratories, a 2-year-old Newtown, Pennsylvania, company may have a practical solution to the problem with its ColorPAK board. ColorPAK is a densely populated long board that mounts in any PC or XT long slot or either of the AT's two 8-bit-bus slots. It is designed to replace the standard IBM color/graphics board and to do a whole lot more if asked. It can enhance the output of IBM's standard personal computer color monitor or it can deliver full high-resolution color graphics when driving a Princeton Graphics SR-12 monitor. When used with the IBM (low-resolution) color monitor, ColorPAK provides flicker-free scrolling, additional colors (8 colors at 320 × 200 resolution compared with IBM's 4 colors) as well as composite video output and support for any IBM-compatible light-pen. When used with the Princeton Graphics SR-12 monitor (available from Princeton

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Graphics in Princeton, New Jersey) it can get more information on the screen in text mode (80 columns by 50 rows) and produces color graphics in several flavors:

* 320 × 200, 4 colors
* 320 × 200, 16 colors
* 640 × 200, 2 colors
* 640 × 200, 4 colors
* 640 × 200, 16 colors
* 640 × 400, 4 colors

Tseng's board achieves a flickerless 640 × 400 graphics display on the PGS SR-12 by driving it in a noninterlace mode so that each element is scanned on each pass. (Some graphics systems depend on high-persistence phosphors and skip a line on every other scan. This skip technique is less expensive but it produces scroll-flicker.) For $679 your ColorPAK board includes a small piggyback board called SoftPAK that handles software compatibility between DOS and the Princeton Graphics SR-12. A $580 version of Color-PAK is available for use with the IBM monitor only, but a Tseng Labs spokesman said that many customers are opting for the $679 package for use with the IBM monitor. Later, these users need only acquire the SR-12 and move two jumpers to activate the piggyback board to get high-resolution graphics.

The ColorPAK board is bundled with *Grafix Partner* graphics-processing software from Brightbill, Roberts & Co. *Grafix Partner* enables you to enhance existing software displays interactively. Suppose, for example, you are running Lotus's *1-2-3* with a standard IBM color monitor and the ColorPAK board. If you create a pie chart with *1-2-3*'s standard four colors, you can invoke *Grafix Partner* from the background to enhance the chart by adding new colors or textures (or even symbols) while still in *1-2-3*. The screen then can be photographed, printed, or saved. *Grafix Partner* will then return to its hiding place in memory, and you can continue processing with *1-2-3*.

Installing ColorPAK is simple—the entire process, including opening and closing the box, took me less than 10 minutes.

Tseng Laboratories has a good idea with this product; it is relatively inexpensive, and it can grow as your need for complex graphics grows without consuming additional slots. If ColorPAK has a down-

side, it is only that you're limited to the Princeton Graphics monitor for ultra high-resolution—IBM's new high-resolution color monitors will not work with Color-PAK. On the other hand, Princeton Graphics monitors rank with the best and are reasonably priced.

The Last Word in Monochrome

One good board deserves another, and Tseng Labs has done it again. This time it has come out with UltraPAK, an AT multifunction board with monochrome graphics capabilities. The Tseng board is long; it uses one of the AT's two 8-bit-bus slots.

> UltraPAK uses a single board where the traditional IBM/Hercules configuration requires three to build a system with monochrome graphics, 132 columns, and multiple ports.

UltraPAK replaces the IBM monochrome card and is compatible with all monochrome and graphics software that can run on the Hercules board. Its graphics modes are generally compatible with the IBM color graphics board. In 640 × 200 mode, UltraPAK generates two colors. In the 320 × 200 mode it generates a 4-color gray scale on a green or amber screen.

UltraPAK also has three text modes in addition to the normal 80 columns by 25 rows: 132 columns by 44 rows, 132 by 28, and 132 by 25. Software drivers are included to enable Lotus's *1-2-3* to use the 132 by 44 mode, which increases the viewable portion of a spreadsheet by a factor of three. Tseng said it has identified six other software publishers with systems that can take advantage of the 132-column mode, including several terminal emulators.

While the enhanced AT comes with a single card that provides serial and parallel ports, many AT users are opting to start from scratch. UltraPAK uses a single

board where the traditional IBM/Hercules configuration requires three to build a system with monochrome graphics, 132 columns, and multiple ports.

Multifunction Boards

One of the AT's more noteworthy features is its bounty of expansion slots, a grand total of eight. Well, almost eight, that is. One of them is taken up by the disk controller card that comes with the system, while another is occupied by a video display card. That leaves you with six expansion slots to use in the most economical way possible.

If you happen to be a devoted patron of Big Blue, you'll want to consider the options available from the same people who brought you the AT. Let's suppose that you either have the enhanced model with a full 512K of RAM installed or were able to locate 18 of the special piggyback 64K chips needed to fill out the AT system motherboard.

You'll probably want to begin by upgrading your machine to the full 640K that DOS 3.0 addresses directly by adding IBM's 128K memory expansion unit. Then, of course, there's a useful part of the operating system (you can fully exploit it only on the AT) called VDISK.SYS, a virtual disk, or RAMdisk, that provides the equivalent of one or more additional 1.2-megabyte drives, which operate at a considerably faster I/O speed. In order to use VDISK.SYS, you'll need two of IBM's 512K memory expansion boards plus a second 128K unit. And then if you want to use other things like a printer and maybe even a mouse, you'll have to buy IBM's special 16-bit serial/parallel adapter, plus a serial adapter cable to offset potential compatibility problems with the AT's DB-9 connector.

Have you been adding everything up? The cost for all those IBM expansion boards comes to a staggering list price of $3,165 (not including tax)—and that's over and above the $3,995 cost (not including the monitor or display card) of the base model AT. And if you didn't notice,

there are only two expansion slots left, one of which has only an 8-pin connector. Add an internal modem and a local area network card and that's it!

AST's Answer

There is a better way, one that's more efficient in expansion slot use and potentially more cost effective. AST Research has it, and it is called the Advantage! board. It takes advantage of the AT's potential without the additional IBM overhead, and you can be assured of total compatibility with the IBM product line.

Advantage! sports standard multifunction card features—one serial port (with another optional), a parallel port, and an optional game adapter port—however, what makes it really special is its memory expansion alternatives. As the largest independent manufacturer of peripheral microcomputer products, the Irvine, California-based AST moved quickly after IBM unveiled the AT and became the first third-party firm to provide add-on RAM in user-definable increments of up to 3 megabytes. The company has two boards in one, a main card that holds up to 1.5 megabytes, and an optional piggyback module, the Advantage-Pak, which carries a second bank of up to 1.5 megabytes. But that's not all. As long as they are rated at 150 nanoseconds, you can mix 64K and 256K RAM chips in blocks of 18 chips each. Three DIP switch blocks allow you to set the board for every conceivable combination of functions and memory allocation.

Moreover, if you opted for a base-model AT, you don't need to order those unusual 64K piggyback chips to fill out the system motherboard. All you have to do is just set the switches correctly and the first 384K on the Advantage! board will be assigned to the operating system. With AST's "split memory addressing" system, all remaining memory on the board is assigned to a second, noncontiguous segment beginning at the 1-megabyte address. And the options don't stop there. Say that you have the motherboard fully populated to 512K, plus another 512K IBM memory expansion board. If you set switches to bring system memory up to the allowable 640K, only 128K on the IBM card could be used. But if you set the switches to access the IBM card above the Advantage!

board's memory, every bit of RAM can be utilized.

All of this is clearly explained in the Advantage! user's manual, which is illustrated with dozens of figures and tables and is easily one of the best efforts in computer documentation I have ever seen. Configuration and installation of the board is clearly explained, along with how to make full use of IBM's setup and diagnostic program for the AT. And AST has provided all the extra information anyone could possibly want, including such things as parallel printer port and RS-232 pinouts and addresses, a wiring list for the DB-9 to DB-25 adapter cable, and even the AT system memory map.

The 1.5-megabyte Advantage! board lists for $3,395, but 128K, 512K, and 1125K units are also available at $595, $1,395, and $2,595, respectively. The optional game adapter port and second serial port are priced at $50 each, and the Advantage-Pak booster memory board with no memory installed is another $150.

One cost-effective way to upgrade the minimum configuration Advantage! board would be to purchase all of the chips you will need from a reliable electronics house. One such firm is Microprocessors Unlimited of Beggs, Oklahoma, which frequently refreshes its widely published price list and guarantees overnight delivery. Using its mid-March prices for 256K chips, install-it-yourself RAM can turn out to be a real bargain, at less than $350 for 1.5 megabytes.

Though less-expensive multifunction boards for the AT are bound to appear, I strongly recommend that you stay with AST. Several retail firms report that there are decidedly fewer repairs and returns of the AST boards.

Mass Data Storage

Over the last few months the glittering image of the PC AT has acquired a certain patina—some would say tarnish—because of problems with the data storage hardware. The core of the problem seems to be in the 20-megabyte hard disk from Computer Memories Inc. (CMI) that IBM puts in the enhanced model AT. Let's face it, there's ample evidence that the CMI drive stinks. I don't just mean the chunks of bad sectors, up to 50K in size, that AT users have encountered; there are also reports that the CMI drive vacuums up data files.

There's also the potential for "sudden hard disk death." Because of their delicate architecture, Winchester-type hard drives have certain inherent limitations. A number of factors, including power failure, shock, and even simple vibration, can produce a head crash that results in partial or total loss of all stored data. More often, a crash will occur when the drive head makes contact with a dust particle or some other contaminant on the disk surface. Even if the hardware is not severely damaged, it's still going to put an end to 10 megabytes or more of files. Add to this the fact that the AT has over twice the storage capacity of the PC-XT, so twice as much data is at risk.

IOMEGA

Now, out of the West come the thundering hoofbeats of a small Roy, Utah, firm to save the day. Several years ago IOMEGA Corporation developed a top-rated, 8-inch removable 10-megabyte cartridge subsystem called the Alpha-10. Minicomputer manufacturers were quick to recognize the unit's excellent performance, reliability, and superior cost-per-megabyte ratio. But, since none of IOMEGA's OEMs (Original Equipment Manufacturers) were positioned to exploit the desktop micro market, the company finally produced its own standalone implementation of the Alpha-10, christening it, for very good reasons, The Bernoulli Box.

In the law of physics that bears his name, Daniel Bernoulli, an eighteenth-century Swiss mathematician, set down the basics of fluid mechanics, or hydrodynamics. A century and a half later, the Wright brothers applied his discovery to the design of aircraft wings. Before long, even baseball pitchers had learned how to use Bernoulli's concept to get a horsehide sphere, plus a little spit, to do the strangest things. Now, IOMEGA has given a new twist to Bernoulli's Law.

Simply stated, the perfect data storage device must combine the high volume, speed, and stability of a hard drive with the pliancy and resilience of a floppy disk. IOMEGA's solution was to let the disk spin free, stabilizing it with the negative air pressure generated (according to Bernoulli's Law) by the spinning disk itself. And although the disk comes within 10 microns (roughly 4 millionths of an inch) of the read/write heads, direct contact between the heads and the disk is always prevented, thanks to that cushion of air. Once stabilized, the head-to-disk spacing remains constant. This not only prevents head crashes but results in extremely low media wear as well.

Problems that would spell the death of a Winchester drive produce only "soft" errors on the Alpha-10. The chance for particulate contamination is negligible, since dust and other such contaminants are literally blown away from the recording surface. And, unlike other systems that need to be completely sealed, the IOMEGA cartridge is designed to open once inside the drive. Indeed, the Bernoulli Box has a greater ability to resist shock and vibration than any other fixed or removable storage system now available. Officially IOMEGA rates its product as able to withstand 3 gravities of shock for 20 millisec-

onds during disk I/O, but that is probably a very conservative figure.

IOMEGA's package consists of a drive controller card, the Bernoulli Box itself with one or two of the Alpha-10 drives inside, a three-pack of 8-inch cartridges, software, and documentation. A special head-cleaning kit is also available, but you won't need it unless you ordinarily use your AT in a very polluted environment.

Installation of the drive controller card in the AT is easy, thanks to IOMEGA's straightforward documentation. A 37-pin connector on the card edge is attached with a thick cable to the Bernoulli Box, which comes equipped with its own power supply and fan. The sturdy construction of the Box makes it an ideal platform for the AT itself.

The Bernoulli Box software (Version 2.3) consists of a special CONFIG.SYS file, an Alpha-10 device driver, and related format, copy, backup, and restore utilities that are necessarily different from those of PC-DOS. The cartridges, which have a manual write-protect switch, come with their own servo tracks preformatted on the disk, but you must initialize each cartridge before data can be written to it. The format utility allows you to specify certain options, including a verify routine that eliminates any suspicious or defective sectors.

The Bernoulli Box Score

With the proper CONFIG.SYS file, utilities, and device driver (the latter implemented with an AUTOEXEC.BAT file) all in place on a DOS system disk, the Bernoulli-based AT is ready to go—and I mean go! A full 10-megabyte cartridge can be backed up in 4 minutes flat. Even though the rotation speed of an Alpha-10 drive is only half that of a Winchester, the Alpha-10's density of data recording is so great that it achieves the same data transfer rate as a hard disk drive.

All told, IOMEGA's product is a knockout. Extremely quiet in operation, rock-solid reliable, and built like a brick, the Bernoulli Box is an excellent vehicle for either archival, backup, or primary storage of both application programs and data files. With the lowest cost per megabyte of any mass storage system, the Alpha-10 drives also offer the unbeatable advantage of total security. At the end of the day, you can easily remove the cartridge and lock it away—no worries about some teenage hacker gaining access to your data.

Can a great product be made even better? Sure, and it's a good bet that IOMEGA will do this in two specific areas. First of all, with the right chips on the controller board, Bernoulli Box cartridges can be made self-booting. This feature is already available to PC users but was still in the development stage on the AT as of mid-March. Further down the road is the possibility of doubling the storage capacity on each cartridge. That would make it possible to put a full 40 megabytes of removable media on-line at one time.

Up the AT

You might not be sold on the idea of a Bernoulli Box—perhaps data security is not a key concern, or perhaps your business uses a database so big that a few files have already grown to more than 10 megabytes in size. You can wait for someone to solve the problems of the AT's 20-megabyte drives, but you'll still eventually run up against the limitations on both the size and number of internal fixed drives.

If you want maximum storage capability for your AT, as much as 240 megabytes internal—believe it or not—then Emerald Systems of San Diego, California, has the drives for you. Those of you who've studied the PC-DOS *Technical Reference* manual may be somewhat skeptical, since

Microsoft and IBM make it clear that DOS 3.0 can't look at more than 32 megabytes at a time. But somehow Emerald Systems found a way to overcome that barrier, producing both 60- and 120-megabyte drives that list for $5,850 and $8,850, respectively. And for the very attractive (albeit hefty) price of $15,850, you get a full 240 megabytes of internal fixed disk storage in the AT—that's like getting 24 10-megabyte hard drives at only $660 each, and you can access them as just two volumes.

The Emerald Systems drive is a breeze to install and use, and rock-steady reliable. The unit we tested was the PS70-3002, which came preformatted from the factory and needed only to be initialized with the IBM's bios and COMMAND.COM rou-

The Bernoulli Box

PS70-3002 Hard Disk

tines. This can be done quickly with the completely menu-driven software provided. Installation of the drive is as easy as hooking up data and drive cables to it and sliding it into the center slot of the AT.

Just to be on the safe side, we ran a complete reinitialization and format. The simplified Emerald installation software replaces the two DOS utilities FDISK (which allocates a portion of the drive for use by DOS) and FORMAT (which initializes the DOS area). Menu options give you the opportunity to update the operating system and BIOS at any point in the future and perform a surface analysis of the drive if there's any doubt about its continued

performance. When the program detects bad tracks, it simply locks them out. All or just part of the disk can be allocated to DOS, and there's an option that allows you to subdivide the drive into as many as 24 volumes.

One important Emerald advantage is its own cache memory, which allows data to be stored in RAM for the fastest access time possible. Another feature, Emerald's backup/restore utility is designed for use with the company's PS60-2000 internal cartridge backup system (not tested for this article), which is priced at $1,950. The company claims that the utility lets you perform a full-scale reproduction of an en-

tire volume or do it selectively by directory or individual file, with the option to backup or restore only those files modified after a specific date and time.

With their high data-storage capacity, the products in the Emerald line can greatly enhance the AT's potential for use in LAN fileserver applications. Fast and easy to use, the drives are ideal for companies that don't want to worry about hardware limitations on database growth over the coming years.

Everex Redux

Anyone who has attempted to back up the enhanced AT's 20-megabyte hard

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AT Disk I/O Speed

The benchmark that we used permits stopwatch timing of drive speed in completing a two-phase test. A 65,000-byte file is written in sequential mode, and then a random access read/write of the same file is performed. Times for sequential access I/O vary depending upon the operating mode of the drive; random access I/O involves the additional factor of seek time.

Written in C, the test was run with the AT operating at its

standard CPU clock speed of 6 MHz and then at an improved 9 MHz speed with a substitute clock crystal installed.

Interpretation:

The dual-speed Sbugart 475 drive operating in high capacity mode demonstrated the benefit of the higher of its two rotational speeds (360 rpm) where random access disk I/O is involved. By contrast, the performance of the Kodak TeamMate drive, which has a fixed 360 rpm speed, was disappointing, particu-

larly when operating at the 9 MHz CPU clock speed.

Despite a rotational speed of only half that of a Winchester drive, the Bernoulli Box performed favorably in comparison with IBM's CMI hard drive. The outstanding performance of the Emerald PS70 in random access I/O appears due in large part to the disk cache software supplied with the drive. But nothing beats DOS 3.0 VDISK (virtual/RAMdisk) for speed.

		Benchmark Time (in seconds)	
Drive	CPU Speed	Sequential	Random Access
Shugart 475 360K diskette	-6 MHz -9 MHz	47 26	221.3 214.7
Shugart 475 1.2-MB diskette	-6 MHz -9 MHz	46 24.7	189.3 179.0
Kodak TeamMate 2.78-MB diskette	-6 MHz -9 MHz	46 34.5	275.0 265.5
Bernoulli Box 10-MB cartridge	-6 MHz -9 MHz	26.7 16.3	56.8 50.2
IBM's CMI 20-MB hard disk	-6 MHz -9 MHz	24.4 NT	46.7
Emerald PS70 60-MB hard disk	-6 MHz -9 MHz	24.2 15.6	26.0 21.4
DOS 3.0 VDISK	-6 MHz -9 MHz	23.2 15.3	11.3 7.4

NT = Not tested

This benchmark is based upon one devised by Jerry Houston, Jim Brodrick, and Les Kent and published in BYTE Magazine, August 1985, pp. 92–94.

drive onto diskettes—even onto the 1.2-megabyte diskettes available for the AT—has learned the hard way that there just has to be a better way to archive files. Everex Systems's EXCELL 4500-AT half-height streaming-tape subsystem may give you this better way.

A streaming-tape system, as its name implies, is a tape drive that runs continuously at a relatively high speed while information is dumped to it or read from it.

Mechanically and electronically these tape backup devices are similar to the familiar household cassette recorders. Electromagnetic write heads record information by reorganizing the tape's

> IBM and Microsoft make it clear that DOS can't look at more than 32-MB at a time. But somehow Emerald Systems found a way to overcome that barrier, producing both 60- and 120-MB drives.

magnetically sensitive surface. Electromagnetic read heads, in turn, sense these "data" spots and report them back.

From the user's viewpoint, speed (data transfer rates) and data integrity (error rates) are the most important factors in a tape system's operation. If the device isn't quick, you might as well stick with floppies. And, if there are errors introduced to the data, who needs a backup?

The Everex system is quick. It takes only 2 minutes and 30 seconds to back up 10 megabytes of data. On the other hand, it takes about an hour to do the same job with floppies.

The system has copy-protected software that enables you to do fast mirror-image backups or slower file-by-file backups. The EXCELL also can back up in the mirror-image mode and then to read back data in the file-by-file mode.

With this option, it becomes practical to send large files from location to location

on tape rather than on delicate floppies. Moreover, the two machines at either end don't need to have identically formatted hard disks.

You do file-by-file backup using single filenames or batch commands that enable you to select the data to be backed up by size, date, or last update or to use standard DOS wildcard characters.

In addition, diagnostic tests for the drive controller card and the tape drive are included, and a verification utility for the tapes themselves is supplied.

The EXCELL 4500-AT manages to cram 8,000 bytes per inch onto a 1/4-inch-wide tape. This storage feat is made possible, according to Everex, by high-precision head alignment and automatic tape positioning. The tape motor is mounted away from the tape head to avoid stretching the tape, and the entire system is mounted in a heavy frame in order to give it additional stability.

Those of you who have used other tape backup systems will also appreciate the EXCELL's cartridge-locking mechanism that prevents damage to the tape and the head. In addition, the system automatically erases the tape before writing.

Trouble in the Cards

A word of warning: Make sure you inspect the controller board before you leave the store. Early versions of the EXCELL 4500-AT (most of the ones on the market) were shipped with a controller board that was designed for the PC and XT. Although this board is electronically identical to the newer slot-independent boards, mounting it in an AT leads to, at best, frustration for the user and, at worst, mechanical damage to the Everex board and to the AT's disk controller board.

The review system that was sent to *PC Magazine* came with the earlier board. It was an 8-bit card with an apron running down beyond the end of the contact strip. This design required using one of the two 8-bit slots on the AT. However, the outer left-hand slot is so far from the drive mounting position that the ribbon cable from the board to the tape drive simply wouldn't reach.

The inner right-hand 8-bit slot is adjacent to the AT's own drive controller. Installing the card here leaves too little room

between slots for the ribbon cable, which must be folded under the AT's controller card, then bent back between the power supply and the drive housings. These multiple folds put considerable strain on both the EXCELL and the AT controller boards.

A newer version of the EXCELL controller board has no extended apron and is slot independent. Therefore, it can be mounted in any open slot—ideally one with an adjacent empty slot to handle the necessary cable folds.

Everex is the first company to offer such a high-capacity tape drive (45 megabytes) in an half-height, internally mounted package. With this size convenience and its speed and back up mode flexibility, the EXCELL 4500-AT could be the answer to the AT back-up blues.

Floppy Drives and Backup

Have you ever wondered why IBM chose 1.2 megabytes as the size for the AT's high-capacity 360 rpm, 5¼-inch disk drive? The answer is compatibility. The new format is exactly equal in volume to the standard double-sided, double-density 8-inch disks used in older IBM equipment such as the Displaywriter. Each data byte has the same relative location on the 8- and the 5¼-inch disks; directories and other pointers that indicate absolute disk locations can be copied over intact. Nevertheless, in this case the price of compatibility is a certain degree of incompatibility.

While the 1.2-megabyte floppy drives used on the AT can read and write the standard DOS 2.x, 360K floppies, the disk it creates or updates are not likely to be readable in standard PC or XT drives because the AT drives write a more narrow track and represent data bits that are smaller than the bits recorded on ordinary media. On a standard AT, then, the only way to write floppy disks that stand a chance of being read on other IBM equipment is with the optional 360K half-height drive.

In some respects, the AT is quite flexible when it comes to disk drive options.

TeamMate 1103

But the AT can't handle more than three physical drives—and that makes a second 360K floppy drive and a second hard disk drive mutually exclusive! Once again, the only way to solve the problem of AT-to-PC compatibility is to find a third party that supplies drives that will outperform the IBM drives.

Fast, and Faster

Last November, Shugart Corporation became the first American firm to produce a dual-speed drive that works well in the AT with the high-density media and creates regular diskettes that are readable in all the other PCs and compatibles.

The flexibility of the Shugart drive is due to its dual-speed read/write channels and brushless dual-speed, direct-drive motor, which ensures that both speeds are constant.

The compatibility gained by using the Shugart 475 drive in the AT does have its price, however. To ensure a smooth rate of data transfer from the AT's own 1.2-megabyte drive to a 360K floppy, IBM elected to have both drives always operating at the faster speed of 360 rpm. Consequently, the disk controller card in the AT is not quite smart enough to cope with the speed changes the Shugart 475 drive makes.

For example, with two of the dual-speed Shugart drives installed, if you try to run an application program from a regular 360K diskette in drive A: and write data files to a 1.2-megabyte diskette in the B: drive, the system will send its "Abort, Re-

try, Ignore?" message every time any data I/O is attempted to a different drive. You must then wait for the drive light to go off before pressing "R" to continue. Actually, the problem will only arise if you elect to use high-capacity data disks along with copy-protected programs that can't be transferred to a 1.2-megabyte diskette. And most copy-protected application programs on the market these days have been sufficiently error-trapped to recover from such a disk I/O error.

Toward the end of 1984, as the result of a management decision, Shugart Corporation was disposed of by Xerox, which has been its parent company since 1978. And what's become of those Shugart 475 drives? As of February 15 the Japanese conglomerate, Matsushita, took over the entire Shugart mini-floppy line, including the members of Shugart's engineering team. The Shugart drive has since reappeared as the Panasonic JU-475.

How to Stuff a Wild Floppy

As an integral part of checking out the operation of third-party drives on the AT, we also tested the high-capacity media available. The old scheme by which the industry rated floppy disks as single- or double-sided and either single-, double-, or quad-density no longer applies for the AT. But until the manufacturers can settle on a rating scale for the new disks, they will be tagged as either "High Capacity" (IBM), "High Density" (BASF, Maxell and Memorex), or "Ultra High Resolution" (Dysan).

Of the major brands tested (IBM, BASF, Maxell, Memorex, and Dysan), all disks formatted without error except for one from the Maxell box, which had 15K in bad sectors that could not be recovered. However, the Maxell box contained an explicit lifetime warranty that offers to replace any defective product at no charge.

Teamwork from Data Tech

Data Technology Corp. of Santa Clara, California, has just produced an AT-compatible Kodak 3.3-megabyte floppy disk add-in subsystem, the TeamMate 1103. The package consists of one or two Kodak drives and a TeamMate disk controller card, which supplements but does not replace the card already in the AT. A

major feature of the Data Technology package is its downward compatibility, that is, it can read—but not write to—conventional 360K and 1.2-megabyte diskettes. Let's see a hard disk match that!

However, the TeamMate's technology offers more than just high-capacity data storage. The Kodak 3.3-megabyte drive uses two stepper motors, one to coarse position the read/write heads on a desired track and another to continuously fine position the heads to the track's center line. Using the prerecorded servo data on each high-capacity diskette, the TeamMate's fine-positioning system assures disk interchangeability from drive to drive. And since the same TeamMate hardware can be installed in PCs and XTs as well, the sys-

Panasonic JU-475

tem is ideal for high-capacity data exchange. Unfortunately, as the benchmark figures indicate, on the AT this interchangeability advantage takes its toll on the I/O speed, possibly because of the constant coarse- and fine-positioning operations.

With the help of Data Technology's well-illustrated user's manual, installation of the TeamMate is a piece of cake. Once the jumpers are properly positioned on the controller card and the drive cable is attached, the unit's card can be inserted into any of the AT expansion slots. The Kodak drive can be installed easily under the AT's 1.2-megabyte diskette. The jumper settings on the controller card give you as much (or as little) downward compatibility as you

desire: Either 192 (Kodak mode) and 48 tpi; 192, 96, and 48 tpi; or just 192 tpi.

The effect of the TeamMate on the AT's drive designations is extensive. Each mode of operation in the Kodak drive is given a different drive assignment. Thus, with a regular AT 1.2-megabyte system drive, the Kodak drive, and a hard disk, the drive assignments would be as follows: drive A: is the AT's 1.2-megabyte drive; B: is the Kodak read-only mode for standard 360K diskettes (48 tpi); C: is the Kodak read-only mode for standard 1.2-megabyte diskettes (96 tpi); D: is the system hard disk; E: is the Kodak read/write mode for its own high-density diskettes (192 tpi). The AT's software-selectable system switches must be set according to this 5-drive configuration.

Alternative Disk Style

The primary advantage of the Team-Mate is that it offers you a viable floppy-disk alternative to cartridge- or streaming-tape backup systems. For many users, the 5¼-inch floppy is the most comfortable, trusted, and familiar means of data storage, and, as well, it takes only eight of the new Kodak diskettes to do a full backup of the AT's 20-megabyte drive. At the current price of $15 each, the Kodak HD 600 diskettes are, byte for byte, slightly more expensive than other available methods, but their availability should bring the same sort of price cuts that have recently affected the 360K and 1.2-megabyte disks.

Kodak has taken the high-capacity 5¼-inch floppy a big step down the road to mega-memory with these new 3.3-megabyte (unformatted) disks.

HD 600 disks are rated at 192 tpi, 17 sectors—that translates into 2.78 megabytes when formatted. The disks even look different. The write-protect notch, for instance, has been moved to the bottom edge—much like that of an 8-inch disk, but in the opposite corner.

You don't have to worry about how to get DOS to format this 2.78-megabyte floppy—It can't. In fact, the diskettes are

> A major feature of the Data Technology package is its downward compatibility. It can read—but not write—to conventional 360K and 1.2-MB diskettes.

clearly labeled as preformatted. This is because the ultra-fine magnetic servo markings used to accurately position a drive's read/write heads can only be laid down with high-precision equipment.

You do have to use DOS FDISK to initialize a DOS partition on the Kodak floppy, just as you would a hard disk. But, if for any reason you totally crash a diskette, it must be returned to the manufacturer for reformatting.

The Big BAKUP Giveaway

To make TeamMate even more attractive, Data Technology includes a free copy of *BAKUP* with each of the Kodak drives. *BAKUP* is a $149.95 standalone backup/restore utility that its manufacturer, InfoTools of Cupertino, California, also markets separately.

Most people work on only a few files a day, so their daily backup needs are small. "If you are really conscientious," Steve Roberts, TeamMate's director of retail operations explained, "you'll write down the name of every file you work on each day and where it is, and then at the end of the day, you'll backup each one. Most people just don't have the time or the inclination, so they have two choices: backup the entire hard disk daily or not at all."

When used with TeamMate, *BAKUP* can speed, automate, and manage the archiving process by creating a database of backup information. It catalogs if, where, and when a file was backed up, and on which of several floppies, each with its own volume label, the data is located. This process allows you to do a first-time full backup of your entire hard disk in roughly half an hour and then do daily backups of just updated files in only a few minutes. *BAKUP* performs all the book-keeping operations needed to manage the process, which can be done with 360K or 1.2-megabyte disks as well as the 2.78-megabyte Kodaks. Should your files be too large to fit on a Kodak diskette, *BAKUP* will split and rejoin them automatically. The program also provides for multilevel restoration—you can choose which version of a file to restore—the original, intermediate, or final form.

The only problem with *BAKUP* is that InfoTools has chosen to copy-protect the program. Like most people, I have come to accept the presence of some sort of copy-protection on application programs, but to find it on a utility strikes me as something of a contradiction in terms. Nevertheless, InfoTools has promised that the 3.04 version of *BAKUP* will include a "de-install" feature that makes it possible to move the program from computer to computer. In addition, it will offer large volume support. With free software like this, Data Technology's TeamMate is a winner.

Manufacturers seem to agree that the market for dual-speed 360K/1.2-megabyte drives will last 2 years at most. They be-

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live by then the entire industry, both hardware and software vendors will have shifted over to higher-capacity drives and storage media. Steve Duffy, product manager for the Shugart Model 475, said that prior to his company's demise, it had begun work on a 6.6-megabyte drive, with the goal of getting 10 megabytes on a 5¼-inch floppy!

Utilitarian Utilities

When you use the DOS TREE command, subdirectories and filenames scroll up the screen at breakneck speed, displaying more blank lines than information. What it should do, instead, is display a real schematic of the relationship between all the directories, subdirectories, sub-subdirectories, and so forth on the logged drive.

Recently, IBM has started marketing a program that does that. It is the exclusive distributor for what it calls Personally Developed Software, which consists of programs produced by IBM employees. Of interest to AT users is IBM's Utilities Package, a collection of five diskettes, sold individually at an average price of $19.95, but also available as a package deal for $56.95. One of the five, *Utilities II*, includes a program called DOS Tree Display.

The program's TREED.COM file displays a concise, alphabetized, graphics-character-defined map of subdirectories on the logged drive. TREED.COM does everything the DOS TREE command should do. It's a simple yet quite useful program that, hopefully, IBM will include with future versions of DOS. However, be forewarned: The author failed to error-trap his work fully. If you try to invoke the program from a floppy disk that has no subdirectories, it will write garbage to the screen and cause the computer to hang, forcing you to reboot the system.

The PATH Command

Far more sophisticated is *File Facility*, another of the disks in IBM's Utilities Package. To understand

the usefulness of this program, think a moment about Set Search Directory—the one big limitation inherent in DOS's PATH command. It finds only executable files, such as those with a .COM, .EXE, or .BAT extension. However, when used in conjunction with *File Facility's* FILE-FAC.COM, the PATH command can process any type of file—data, overlay, or whatever—as long as the application program calling the file uses standard DOS file-handling techniques.

With *File Facility* (the authors usurped their program to be renamed FF.COM), you have the capability to organize your subdirectories by file type. In other words, your personal letters can be kept in one subdirectory, separate from the word processor you use to create them, while all of

> With File Facility, you can organize your files the way you want. Database, spreadsheet, and word processor-created files can all be put in the same subdirectory.

your business correspondence is put somewhere else. Using FF.COM, you are able to organize your files the way you want them. This not only makes the AT easier to use, but it also increases the chances that you'll back up your files on a regular basis. Database, spreadsheet, and word processor-created files can all be put in the same subdirectory.

In addition, if you don't have the *BAK-UP* program mentioned earlier, you'll be far more likely to perform your security housekeeping chores with only one subdirectory's worth of updated files to copy each day.

As is always the case with a real gem of a utility, however, there are advantages and disadvantages. On the plus side is the fact that FF.COM will not process DELETE and RENAME commands. This restriction prevents you from accidentally deleting or renaming a backup copy of a target file that is located elsewhere. On the other hand, some features of the program are quite powerful and must, therefore, be used with extreme caution. For example, FF.COM will not create a new file if the same filename appears anywhere in the current defined path. The existing file is always overwritten. This makes it impossible to format a DOS System diskette. The format function will be performed, but the System files (COMMAND.COM, IBMBIO.COM, and IBMDOS.COM) will not be written on the new diskette—just rewritten to the originals on the default drive.

File Facility is best used when invoked for a limited purpose from a batch file that will, in effect, disable FF.COM once the function has been completed. This batch file must also be consistent with the way that function is performed. For instance, when updating an existing file, your application programs read a data file and then

write the updated version to a new file with a different name or extension. When done, the program deletes the old file and changes the new file to the original name. To the user it appears that a simple update has occurred. But using FF.COM is different: Unless you're careful to make the default directory the one that

contains the data file, the old file won't be deleted, and the update will be put some place you didn't intend.

In order to fully exploit the power of *File Facility*, you must read and digest the detailed instructions that come with the program—and this is no small assignment in itself. Like the rest of the programs in IBM's Personally Developed Software series, all the documentation is on the disk along with a utility for viewing it on the screen or dumping it to the printer. Unfortunately, several fundamental concepts that you need to understand the program's operation are buried like subroutines in various parts of the text, and some important terms are left undefined. In particular, the expressions OPEN and CREATE are used repeatedly, but users who don't have access to the DOS *Technical Reference Manual* may have some difficulty understanding what these terms are supposed to mean.

However, most of the programs that make up the Utilities Package are excellent. My advice is for you to grab them right away before IBM realizes that one or two might not have passed quality control and temporarily holds up sales of the product. If you don't think that's likely to happen, just try buying an enhanced AT right now. . . .

TDA Templates

The keyboard template places information that won't fit on the screen within your range of vision. For several years now, the IBM PC keyboard has been the resting place for template galore. However, the full-size templates that fit the PC don't fit the AT. IBM seems to have decided that anything called Advanced Technology should be 3/8 of an inch longer.

Quick-fix solutions bridge the compatibility gap between the AT and PC keyboards in different ways. *DisplayWrite 3* users can place similar, but non-form-fitting 13½- by 2¾-inch plastic rectangles just above the keys, while *MicroSoft Word 2.0* comes equipped with a double-sided, upside-down U-shaped template which, because it lacks a bottom edge, fits either keyboard. However, none of the well-known manufacturers of third-party accessory templates, like Systems Management Associates' PC-DocuMate series, has yet

TDA Template Series

Utilities Package

come forward with something that will fit the AT, let alone be interchangeable with the PC.

Enter TDA, Inc., of Herndon, Virginia, with a simple but effective design priced at $19.95. Each template in the TDA Template Series is molded to fit on top of—not just around—that little ridge known as the keyboard "pencil tray" on either the PC or the AT, with an attached open rectangle on the left that is meant to encompass the function keys.

In the case of its *1-2-3* template, TDA puts the 2- by 14-inch flat surface of its product to good use, defining the principal components of all nine "slash" command trees, as well as labeling the *1-2-3* function keys. On the curve over the pencil ridge, arithmetic and logical operators are also

shown along with entry and edit mode key functions.

What makes the TDA line noticeably different from other such program templates is the presence of a "mini-manual" (size 2½ by 3 inches) affixed to the right side. Thor Duffin, TDA's president, notes that many of the most popular application packages "can be boiled down to a few basic subjects. You find yourself doing the same set of tasks over and over again." Thus each of the mini-manuals addresses its own particular set of tasks. The one for *1-2-3* covers eight major topics—entry, editing, formatting, data management, graphing, macros, functions, and printing—in 82 pages. With it you can doublecheck a *1-2-3* command without having to balance the Lotus documentation on your knee while trying to type.

TDA has similar templates available for use with *Word Perfect 4.0* and *Symphony*; versions for *DisplayWrite 3*, *MultiMate*, *WordStar*, and *WordStar 2000* will appear shortly. At first glimpse, these templates seem to have one disadvantage: the minimanual is located right over the LEDs that display the status of the AT's CapsLock, NumLock, and ScrollLock keys. Nevertheless, following the example of Lotus's *1-2-3*, a growing number of software firms have chosen to indicate on screen whether or not these keys have been depressed. Programs that don't display this information can use UPNUM, a utility readily available free from users groups and PC bulletin boards that displays the status of CapsLock and NumLock in an upper corner of the screen.

Whether you choose to have the AT's LEDs glowing or install the TDA template and mini-manual, you'll end up being ahead either way.

Networking and Communications

T he AT has been made the fulcrum of IBM's new broadband local area network, but have you seen what that's going to cost? As a fileserver for IBM's LAN, the AT must be equipped with a transistor unit ($595). Then, each micro connected to it will need a network adapter (at $695), coaxial cable ($29–$99), and a special IBM long/short distance kit (other $39–$89). In other words, the cash register's going to ring up at least $6,500 just to network eight existing terminals from one AT.

The Software Link, Inc., offers a better (and cheaper) way. Its unique MultiLink Advanced system doesn't rely on the presence of costly network interface boards. Instead, it uses software and RS-232 connections to add multiuser, multitasking features to the AT. Even without attaching other terminals, you can turn such, compiles, or print-spooling operations concurrently with other programs. And rejoice—the software-hardware pricing to network eight dumb terminals with MultiLink runs to less than $1,300 (terminals and additional RAM capability not included).

MultiLink Advanced Version 3.0 delivers on its promise of convenience, speed, and flexibility by partitioning available RAM into as many as nine separate environments. When multitasking, you can switch from one task to another by simply pressing two keys. Each task appears as though it's running on its own separate computer.

To ensure that each configured partition is given periodic access to the processor, MultiLink's time-sharing utility can periodically interrupt tasks being performed. Another utility allocates variable time slices to different tasks, giving preference to those deemed more important.

MultiLink requires about 16K of overhead, and the background partitions add another 9K each for buffers and other system areas. Regardless of the number of partitions, however, only one copy of DOS is loaded into system memory, so the effective overhead per background partition is very small. Other utilities provided on the MultiLink disk permit shared access

to disk files, print spooling, keyboard enhancement, unattended communications (an excellent bulletin board that takes full advantage of the concurrent features of MultiLink), and an interfacing capability for programmers.

If you go by the book, the IBM AT is capable of supporting no more than two serial RS-232 ports, COM1 and COM2. But with The Software Link's special MultiLink:Port Board, serial ports COM3 through COM8 can be addressed.

To make multi-user operations possible on the AT (or on the XT), Software Link recommends the JRAM8 Memory Board produced by Tall Tree Systems of Palo Alto, California. In fact, since the MultiLink software uses XT-compatible bank-switching techniques instead of the AT's new virtual address mode for accessing memory, the 2-megabyte capacity of the JRAM8 board is currently the only way to use the multitasking capability of MultiLink. With the JRAM board installed, the foreground partition can be as large as 640K, and each of the eight background tasks can use up to 448K.

The software works smoothly, even in conjunction with programs like 1-2-3. So if you're in the market for a small-scale LAN or want to set up a limited multi-user system using the AT as a fileserver, by all means consider MultiLink.

AT à la Modem

I'd tell you about the direct-connect modem that IBM recommends for use with the AT, but there

isn't one. For whatever reason, Big Blue left the market open on that count, and Hayes Microcomputer Products moved in before the AT even touched the ground. Haye's internal Smartcom 1200B and standalone Smartmodem 1200 have been the de facto modem standards for IBM micros.

Today you've got to have some pretty good reasons to buck the Hayes-compatible trend in PC-XT and AT communications programs. The principal categories to compare are price, features, and flexibility. A modem that's better in one and equal to Hayes in the others is worth considering. If you find a unit superior to Hayes in two or three categories, you've got a winner. Case in point: the Infomate 212PC internal modem.

The manufacturer of the Infomate 212PC, Cermetek Microelectronics of Sunnyvale, California, has been in the electronic components business for 17 years and began marketing its own modems in 1980. Though it is unfamiliar to end users, Cermetek is recognized and respected among industry insiders.

The 212PC is a full duplex (Bell 212A and Bell 103-compatible) 1200/300/110 modem that has auto-answer, autodial, and autoselect tone/rotary dial capabilities, with a 40-character command buffer. Though it lacks the speaker found in Hayes modems, the engineers at Cermetek provide a useful substitute, "call progress monitoring," which reports when it encounters any one of six different conditions: no answer, ring-back, busy signal,

faulty line, probable voice response, and modem answer tone. And in place of the single self-test feature of the Hayes Smartmodem 1200B, the Infomate 212PC sports eight diagnostic tests.

The 212PC plugs into one of the AT's two short (8-bit) slots and a modular telephone cord is supplied for hooking it up to the phone lines. The manual provides clear and understandable instructions on every conceivable variation in operation, though the absence of page numbers in the index is a bit perplexing. Also included, on disk, is a rudimentary data communications program called *ModemMate*. Unfortunately, this software operates only in 7-bit word, even parity mode when run on the AT, so it can send and receive files only in ASCII format.

To test Infomate, I used a copy of Microstuf's *Crosstalk XVI*—Cermetek's 11-page Application Bulletin No. 102 provided all the extra details I needed to configure the program. The only major changes to the *Crosstalk* (Hayes-compatible) default settings are the dial prefix (DP), dial suffix (DS), and answer prefix (AP) commands. The Infomate modem worked quite well with *Crosstalk XVI*.

The Infomate 212PC garners its first Hayes-superior rating in either the features or the flexibility category, however you define them. But what about that two-category advantage I implied earlier? With Cermetek the knockout advantage is the price tag—for a limited time the Infomate 212PC can be yours for only $149. (*Editor's Note: The special price is because the

212PC is being discontinued. Cermetek officials say they will still support it but are replacing it with a new model, the 1200 PC, which will be Hayes compatible, have a speaker, and cost $495.)

The Dangling Conversation

"Dr. Watson, come in here. I want you!" According to tradition, those were the first words uttered over the first telephone

> When multitasking with MultiLink, you can switch from one task to another by simply pressing two keys. Each task appears as though it's running on its own separate computer.

phone by Alexander Graham Bell. Ever since, people have insisted on communicating, short or long distance, by voice. The demand for voice communications now extends to the desktop micro. By now most of us have even received a telephone call from a computer. This sort of thing has been going on for several years, but until very recently it cost big bucks and had to be done on a mainframe.

Now, CMC International, a firm

known for its line of Targa hard disks, offers an expansion board that turns the AT into a sophisticated telephone management system. Called PC Dial/Log, it digitally records voice data from the telephone and stores it on floppy or hard disks. With a combination of software and circuitry, the digitized data can be retrieved and reconstructed as sounds, for retransmission through your telephone receiver.

In addition to the software required, the system consists of an expansion card with two telephone jacks (as on an internal modem) so it can be attached to a standard phone. PC Dial/Log will transmit your prerecorded message to designated numbers. It can record incoming phone messages, as well as address individual outgoing messages to those whom you've given a personal ID code. You can create supplemental files so that different outgoing messages can be played to different groups of phone numbers.

Since it gobbles up a huge amount of storage space for each digitized message (incoming or outgoing), PC Dial/Log is not viable for floppy-based systems, even those which use the newer higher-capacity media. With that sole caveat, I strongly recommend the PC Dial/Log system.

The Best Goes On

There's an important footnote to the suggestions in this article on how you might go about configuring "the ultimate AT." For many who bought into IBM's view of Advanced Technology, the promise of greater speed was the deciding fac-

Infomate 199SA

PC Dial/Log & Concurrent PC Dial/Log

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tor. One market survey showed that over 50 percent of those who purchased an AT in the months following its debut saw the machine's improved processing and disk I/O speed as primary considerations.

When enhanced by the right mass storage device—be it a Bernoulli Box, an Emerald drive, or even IBM's own hard disk (yes, they're shipping again)—the Intel 80286 technology gives a real boost to both sequential and random access I/O. When an AT comes off the assembly line, its CPU clock speed is fixed at 6 MHz. It's possible to replace the 12-MHz crystal on the AT motherboard with an inexpensive substitute and gain a dramatic boost in clock speed to 8 or 9 MHz—possibly even 10 MHz if all your RAM chips are rated at 120 ns. However, the results can be unpre-

> The AT Throttle will give AT users several options for switching the CPU clock speed while the computer is in use.

dictable. And until more users jump aboard the AT bandwagon, most software with timed screen displays will run so fast on the AT that most people won't be able to comfortably read the text.

But, once again, a third-party firm is coming to the rescue. The AT Throttle (patent applied for) will be marketed by Mercury Microcomputer Products, Inc, of Charleston, South Carolina. The company claims that, once installed inside the AT, this little device will give AT users several options for switching the CPU clock speed while the computer is in use.

Those who are still skeptical about the long-term success of Big Blue's micro marvel, take note. ∎

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AT Products Roundup

AST Advantage! and Advantage-Pak
AST Research, Inc.
2121 Alton Ave.
Irvine, CA 92714
(714) 863-1333
List Price: 128K: $595, 512K: $1,395, 1125K: $2,595, 1.5mb: $3,395; add $50 each for second serial port or game port.
The Advantage-Pak is $150.
CIRCLE 685 ON READER SERVICE CARD

BAKUP
InfoTools
10044 S. DeAnza Blvd.
Cupertino, CA 95014
(408) 725-1151
List Price: $149.95
CIRCLE 683 ON READER SERVICE CARD

The Bernoulli Box
IOMEGA Corp.
1821 West 4000 S.
Roy, UT 84067
(801) 776-7330
List Price: $3,695
CIRCLE 684 ON READER SERVICE CARD

ColorPAK and Grafix Partner
Tseng Laboratories, Inc.
205 Pheasant Run
Newtown Commons
Newtown, PA 18940
(215) 968-0502
List Price: $580, $679 with SoftPAK board
CIRCLE 673 ON READER SERVICE CARD

Double-Sided High-Density Flexible Disk
Memorex Corp.
Media Products Group
Santa Clara, CA 95052
(800) 222-1150
List Price: $7.99
CIRCLE 670 ON READER SERVICE CARD

Dysan HC Disk
Dysan
P.O. Box 3418
Sunnyvale, CA 94088-3418
(408) 988-3472
List Price: $11
CIRCLE 668 ON READER SERVICE CARD

EXCELL 4500-AT
Everex Systems, Inc.
47777 Warm Springs Blvd.
Freemont, CA 94539
(415) 498-1111
(800) 821-0806
(800) 821-0807 (in Calif.)
List Price: $1,345
CIRCLE 675 ON READER SERVICE CARD

Graphics Edge
Everex Systems, Inc.
47777 Warm Springs Blvd.
Freemont, CA 94539
(415) 498-1111
(800) 821-0806
(800) 821-0807 (in Calif.)
List Price: $499
CIRCLE 674 ON READER SERVICE CARD

2HD High-Density Disks
BASF Systems Corp.
Crosby Dr.
Bedford, MA 01730
(617) 271-0500
(800) 343-4600
List Price: $8.95
CIRCLE 672 ON READER SERVICE CARD

Infomate 212PC
Cermetek Microelectronics, Inc.
1308 Borregas Ave.
Sunnyvale, CA 94088
(800) 862-6271
List Price: $149 (soon to be discontinued)
CIRCLE 679 ON READER SERVICE CARD

Nonprofit Accounting with PC–FUND

While most accounting systems on the market are aimed at companies that want to build the bottom line, AFI's PC-FUND is designed to deal with the special accounting problems of nonprofit entities.

Not surprisingly, most currently available microcomputer-based accounting software is geared for commercial organizations—those primarily interested in making a profit by selling goods and services in a competitive marketplace. American Fundware, Inc.'s *PC-FUND*, however, was developed to address the accounting chores of nonprofit entities (hospitals, municipal governments, agencies, schools, libraries, religious groups, and so on)—organizations whose main interests are in carrying out worthwhile social objectives, not building the bottom line.

Nonprofit organizations have different accounting needs than profit-making companies. Simplicity is often important because a nonprofit organization may be small and lack accounting, administrative, and data processing resources. A nonprofit agency manager's key concerns are the collection and stewardship of money to meet the group's expenditures. Agencies often have moral (and legal) obligations to donors or taxpayers that certain funds be used for specific purposes. Because of this restriction, an accounting program must include detailed control and reporting capabilities. Money earmarked for specific purposes are accounted for as separate "funds," hence the common term "fund

accounting." The elements of multiple funds and the related interfund transfers add an element of complexity to fund accounting. *PC-FUND* is the most complete set of PC-based applications we've seen that meet the needs of the fund-accounting marketplace.

American Fundware (AFI) first developed a comprehensive set of fund accounting applications in COBOL some years ago, using Data General minicomputer hardware. In early 1983, it implemented the key fund-accounting programs in Microsoft COBOL on the IBM PC and compatibles. Figure 1 shows *PC-FUND*'s main menu, which lists most of the applications available from AFI, although some of the government systems are not yet ported to the PC.

Set-up Help

AFI's business philosophy extends beyond merely producing and selling software. It assumes that most customers will need help implementing fund-accounting software. Indeed, the extensive capabilities of this system make it quite a challenge to set up for anyone with limited computer or fund-accounting experience.

PC-FUND needs a substantial hard disk capacity to house the software. The entire set of program files currently consumes

about 7.3 megabytes of disk space. Consequently, most systems have been preinstalled by AFI for its customers—and most customers have used a 20-megabyte hard disk. By using a new version of Microsoft COBOL, AFI hopes to be able to compact the program files to about 5 megabytes, thus making it possible for you to use it on a PC-XT.

AFI is willing to help each customer select the microcomputer system best suited for the program's requirements. Customers can then bring their hardware with them to AFI's headquarters in Steamboat Springs, Colorado, for several days of personalized training. There is a $300 fee for attending the training session.

Of course, you can buy the software directly from AFI and install it yourself. However, because of its many hard-accounting features, we recommend taking advantage of AFI's installation assistance and training sessions in Steamboat Springs—particularly if you're a skier, and the slopes are open for business.

We reviewed systems that were preinstalled on a PC AT, a PC with an external 20-megabyte Tallgrass hard disk, and a PC with an internal 40-megabyte hard disk. As you might expect, the performance is

PC FACT FILE

PC-FUND

American Fundware, Inc.
P.O. Box 773028
1355 South Lincoln Avenue
Steamboat Springs, CO 80477
(303) 879-5770

List Prices:

American Fundware Security System — $695
General Ledger/Report Writer — $1,295
Accounts Receivable/Meter Billing — $995
Accounts Payable — $995
Purchase Order/Encumbrance — $995
Payroll/Personnel — $995
Budget Forecasting — $995
Fixed Assets/Depreciation — $995
Donor Receipts — $995

Requires: 128K RAM, one disk drive and 10-megabyte hard disk, monochrome or color display, 132-column printer.

CIRCLE 697 ON READER SERVICE CARD

Figure 1: This is the main menu of PC-FUND. It shows all the applications that are currently available as well as some that have not yet been brought down to the PC (those marked *). The security system is accessible through menu item 18.

best on the PC AT. In addition, the AFI development staff has recently ported the applications over to the XENIX operating system, which gives the system multi-user capability.

The *PC-FUND Operations and Installation Guide* is required reading before attending the training class or attempting to install the system yourself. It tells you how to set up subdirectories, batch command files, and clearing funds/accounts and how to set your printer for compressed mode. This guide gives an excellent overview of the "first time" procedures for each application and it discusses the parameters that must be defined during implementation of each application.

AFI Security System

PC-FUND has an elaborate user interface, or "shell module," called the *American Fundware Security System (AFSS)*. It supplies the menu structure, monitors user activity, provides password security, prints reports, and maintains accounting-period tables. The first screen you encounter asks for your user ID and password. If you enter an invalid password more than twice, you are returned to DOS. During the second part of the logon routine, you must enter a valid division and appropriate business date. The business date dictates which accounting period your transactions will be added to during a given work session.

Once you've installed the system, you'll

want to designate one individual to act as security system manager. ID numbers and one of five security levels can be assigned to each user. The security levels range from complete access, to access restricted by division, to data input or inquiry privileges only. With some assistance from AFI, you can install a special program that will control access to an application within a module. While no security system such as this can be guaranteed absolutely foolproof, this one should be adequate for most circumstances. Each user can select and change his or her own password, so the system manager needn't be concerned with this aspect of security.

Unlike most systems, *PC-FUND* can monitor transaction activity by tracking user-ID numbers. The program can produce reports that show who's done what and how long it has taken. This tracking can be used to identify inefficient or overloaded operators. Since the system also logs error messages, you can get a list of all the error messages issued, a help in troubleshooting.

The system offers a handy "delayed processing" mode for programs and reports that are particularly time-consuming. You can specify, in advance, a group of routines to be performed during the night. Also, during normal processing, you may direct reports to the printer or to a file for printing later.

The system can store up to 3 years of accounting records for an organization.

Each year is divided into 12 accounting periods, which may or may not correspond to the calendar months. The date tables you establish serve to specify each of the 12 periods in the previous, current, and next years. Year-end close routines "push down" the data by 1 year.

General Ledger

As with most general ledgers, *PC-FUND*'s general ledger module is based on its chart of accounts. Each *PC-FUND* account number is divided into the following four elements: fund, department, subdepartment, and general ledger account.

This structure allows you to identify the department and the subdepartment associated with each transaction for each account in the fund. *PC-FUND*'s general ledger module lets you prepare informative summaries of your financial records based on any of the four elements in the account number. In developing your financial reports, you can specify an account-code range that identifies logical reporting subgroups. This technique is called "account masking."

Account masks are simply devices that make it easy to specify ranges of account codes. For example, you can call for the summarization of all accounts fitting the "mask" "??220" ("??") are wildcard characters) instead of having to list each of these accounts.

PC-FUND comes with the general ledger listings needed to maintain proper accounting control. These include journal-entry listings with batch totals, a general ledger trial balance, a balance sheet, and a revenue-and-expenditures report.

What really separates the general ledger from those of non-fund-accounting systems, however, is its capability to enter "encumbrance" data and to ensure that transactions are balanced within funds. The AFI general ledger allows you to make interfund journal entries. When you set-up the general ledger module, you can indicate if you would want the system to automatically balance the journal transactions between funds. It does so by creating off-setting (fund-balancing) entries to the appropriate interfund accounts when you make an entry affecting two or more funds. Alternatively, you can opt to have

the program require you to balance journal transactions between funds manually prior to posting them to the general ledger. We suggest you ignore the automatic balancing feature—at least until you have the system under control. It may be a convenience for the person entering data, but it could result in a nightmare of a reconciliation at the end of each month.

PC-FUND's fund orientation is apparent in the data that the general ledger main-

tains. For each account, it is possible to maintain actual, encumbrance, and budget data (see Figure 2). Data associated with the prior year, the current year, and the next year can be maintained. Maintaining next year's data is important when developing a budget for the coming year. The program allows you to work on next year's budget, utilizing historical data, while still posting transactions to the current year's books. Additionally, since AFI realizes no

Figure 2: *Amounts encumbered plus actual amounts spent should not exceed the amount budgeted. Note that, in the first period, the organization is overextended.*

Figure 3: *Budget worksheets, generated by the system, make budget compilation easier.*

organization ever closes its books on the last day of the year, you can simultaneously process general ledger transactions for both the current and prior years. You could conceivably keep the prior year's books open for an entire year (Heaven forbid!).

Budget Forecasting

Coupled with the general ledger, AFI's budget forecasting module supports the formal budgeting process typical in most public agencies and other nonprofit entities. This process involves the initial preparation of the budget based on an extrapolation of historical amounts and other factors, a preliminary review by department and program administrators, the review and approval by elected officials, and finally, the budget's adoption and execution.

The budgeting module helps you develop your budget for a coming year. With this module, you can generate budget worksheets (see Figure 3) showing last year and current-year actual amounts for all general ledger revenue and expenditure accounts; roll the current year's budget into the next year's budget to use as a starting point for developing next year's budget; develop next year's budget by applying fixed amounts and/or percent changes to the rolled-forward last-year budget amounts; print next year's budget in the actual revenue/expenditure financial statement format; and roll the completed budget into the general ledger for use during the coming year. AFI has designed the menu structure to guide you through the process. Should you skip a step in the budgeting process, the system advises you appropriately.

The workhorse report of the budgeting module is the budget worksheet—a "turn-around document." The term *turn-around document* refers to a report that, after review and pencil revisions, can be used as a source document for revising the budget. You can generate worksheets for all revenue and expenditure accounts or for only certain accounts. You can print worksheets for all funds, specific funds, departments, accounts, or any combination thereof.

Since the budgeting module first helps you in preparing the budgeted amounts for a year, you must then distribute the annual budget amounts to each month. To do this, you must specify, using percentages, how you want the amounts distributed to each month. Here too, the general ledger account-masking feature can be employed to specify individual accounts.

The Report Writer

In addition to using the standard reports, you can produce custom reports with a separate report-writer module, which incorporates this account-masking feature. The reporting module only generates reports from general ledger data, although the other *PC-FUND* modules allow you to print reports based on user-specified sorting and data-selecting criteria. The report writer appears to be a bit complicated at first. In a few hours, however, you should be able to produce your first report with minimal reference to the manual. (See Figure 4 for an example of a report definition.)

The structure of the report writer is based on six different report types and eight different line types. The report type defines the columns of the report. The line types define the contents of the lines of the report. Several different line types can be used in a report.

The available report types include the report columns common to general ledger reporting such as:

• current-year budget versus prior-year actual;

• prior-year actual versus current-year actual;

• expenditures as a percentage of revenue for current-year actual and current-year budget;

• expenditures as a percentage of revenue for current-year actual and prior-year actual;

• selected fiscal period; and

• encumbrance, actual, and budget amounts for the current month and the year-to-date.

The report line types provided by AFI can accumulate the total of specific accounts, accumulate the beginning balance of specific accounts, indicate which line is the percentage baseline for expenditure-to-revenue percentage calculations, skip report lines or skip to the top of a new page, initialize various report totals to zero, print the various report totals, print heading or description lines, and print either single or double underscores in the amount columns.

With the first three types, you can use the general ledger account-masking feature, allowing you easy reference to ranges of accounts to include in your custom reports.

If, when you are defining a report, you forget the codes for the various report and

Figure 4: A report definition using PC-FUND's report writer report specification "language."

line types, merely press the Return key, and the list of options appears on your screen. We found this to be a very useful feature—particularly as we developed our initial report.

When you are ready to generate the report, the system writes it to disk to speed your operations. In addition, by writing the file to disk, you can keep a machine-readable copy of the report in the computer if you need to print it again. AFI is working on a program that will allow the report file to be read and converted to the DIF format in order to facilitate exporting the data to popular spreadsheet and database programs.

Encumbrance Accounting

The bill-paying part of the accounting cycle for nonprofit agencies is quite different from commercial accounting. Corporations generally keep track of open purchase orders but make no accounting entry to show them on the books. Public agencies have a greater need to manage cash disbursements since their ability to raise additional tax revenues is limited. Encumbrance accounting is the method used by governmental bodies to ensure that expenditures follow the authorized spending limits. Essentially, the encumbrance-accounting technique involves entering a memorandum in the books when making purchase commitments to indicate that the funds have been reserved to pay for a specific item at some later date. Booking an encumbrance doesn't speed up the actual recognition of an expense—it merely indicates a certain portion of the funds are already spoken for. The expense encumbrance is booked first and then reversed when the actual expense is posted after the entry of a payment voucher into the accounts-payable system. (Anybody want to study governmental accounting?)

Purchase Order/Encumbrance

PC-FUND's optional purchase order and encumbrance module lets you better control this payment process. If you do buy this module, you must also use the accounts payable module. If you simply need to monitor your payables and produce your checks by computer, and if encumbrance accounting is not a concern, the accounts payable module alone will be more than adequate for your needs.

PC-FUND has been designed to write checks from two check-clearing funds (accounts payable and payroll) and to deposit all revenues received in an accounts receivable clearing fund. The advantage of this approach is that you can reduce the number of active checking accounts that you have to maintain. The system will automatically generate interfund transfer entries to properly allocate cash-flow items to the funds.

The processing of approved batches of purchase requisitions is the first step in tallying purchase orders. Transactions are entered in batches—with up to 99 entries

> The report writer seems a bit complicated at first. In a few hours, however, you should be able to produce your first report with minimal reference to the manual.

in each batch. Each requisition produces a purchase order, which can later be printed on blank stock paper or preprinted forms. The individual line-items on the purchase order can be distributed to the appropriate fund's encumbrance account. Batch totals help you confirm that the sum of the line-item amounts equals the purchase-requisition total and the distribution total. Purchase-order data can be edited on-screen until the purchase orders are printed, at which point they are posted to the encumbrance journal. After posting, a journal-entry adjustment would be required to make any corrections.

PC-FUND offers standard reports on purchase-order encumbrances, which include purchase-order history and aging, cash requirements, encumbrance ledgers, and encumbrance summaries by vendor and department.

As in encumbrance accounting, when an invoice for goods or services is received, vouchers need to be prepared and approved for entry into the system. Entering the voucher will "reverse" the associated encumbrance entry. The expense distribution will probably involve debits to expense accounts in one or more of the funds, and the credit would be in the accounts payable clearing fund. The system automatically generates the necessary interfund transfer entries. Here again, a full range of reports is available including an aging, a voucher-distribution listing, and a cash-requirements summary.

Once you have reviewed all the vouchers to your satisfaction, the payment process can begin. The cash-requirements report should help you determine the amount of cash to be expended. You would generally mark whole ranges of vouchers for payment; however, you can also call for a partial payment of a voucher. After producing a preliminary accounts payable register and reviewing it for accuracy, checks can be printed in one of two preprogrammed formats. Forms are available from Data Documents, a national business-forms printer.

Payroll/Personnel

Good payroll/personnel systems must be table- or parameter-driven to allow you to configure the system to your needs. AFI has gone to great lengths to make its system as flexible as possible, giving you an impressive degree of latitude in defining the payroll calculations. The payroll/personnel module allows you to define a very wide range of compensation and deduction types, along with the methods for calculating them. It will even accommodate multiple unions. The AFI system has no predefined payroll periods; thus employees can be paid on whatever schedule is appropriate for your organization. Also, you can have different paycheck cycles for different employees. Employees can be paid on a variety of bases, such as salary, hourly, or a combination of salary and hourly. In addition, you are allowed to enter timecard data on an intrapaycheck cycle. The system allows you to tie each deduction type to an appropriate general ledger account to debit or credit. And, with timecard data, you can specify a nonstandard general ledger account against which to charge an employee's labor.

With this kind of flexibility, it is critical that you properly define the various parameters and tables. You should plan on spending a significant amount of time thinking through all various ramifications

of how you set up the payroll module. AFI is able to assist you in this process. This is one module where such advice is important.

The payroll/personnel module's reporting is solid. Your employee master file and payroll tables can be printed based on data-selection and sort-sequence parameters that you define. Timecard and timesheet edit reports can be produced. Prior to generating paychecks, you can print a disbursements listing to preview the checks. When the paychecks are printed, so are the listings reporting various deductions. You can even specify the order in which the reports are printed. Quarterly earnings and withholding reports are generated as are W-2 forms.

Accounts Receivable/Meter Billing

Nonprofit organizations often have no need for an accounts receivable system. Income is often recorded only when received because there can be no legal claim to donor pledges or membership dues. On the other hand, municipal governments can charge residents for property taxes, water, sewage, and garbage-disposal services. For these reasons, PC-FUND incorporates an accounts receivable module. Included in this module are routines that aid utility-meter billings and compute service charges to rate-payers.

While the definition of a "customer" may vary widely among nonprofit agencies, PC-FUND comes with all the functions required to manage a commercial customer masterfile. The accounts receivable module can run on-line inquiries into customer files, balances, aging, and payment histories, as well as supply an extensive list of standard reports as shown in Figure 5.

The system is able to maintain 99 months of billing history on-line for each customer and use up to 9,999 user-defined charge codes, and any billing cycles, interest rates, and volume discounts you define. Sales-tax tables can be created that reflect local municipality rates. The system provides four programs for printing statements on either preprinted forms or 4- by 6-inch postcards, and these statements can be sorted by ZIP code for bulk mailings.

The utility-meter reading capability can generate route sheets with route and sequence control for the convenience of a utility meter reader. Once meter readings have been entered, a report can be generated based on user-defined deviations from previous readings. This report could be useful in identifying faulty meters, meter-reading errors, or other problems. The usage between meter readings is automatically calculated, and any of a number of rate schemes can be applied. The system supplies a complete meter-reading history for rate-payers.

Donor Receipts

The donor receipts module can be useful for an organization that places a lot of fund raising and needs to keep information about its contributors on file. The donor masterfile lets you maintain such descriptive information about the individual donor as basketball fan, music enthusiast, doctor, lawyer, banker, music fund, sports fund, and so on. The donor's contribution history can be maintained in the computer for up to 99 years.

To assist in fund-raising drives, donor history reports can be generated with user-defined data-selection and sorting-sequence criteria. For example, let's say you want to generate a report listing doctors who contributed $1,000 or more last year, live in a certain region of the country (specific ZIP codes), and you want this information listed in telephone area-code order. No problem—this is the kind of flexibility built into PC-FUND.

The program supplies you with an audit trail of recorded donations. Numbered receipts can be printed for the contributor's tax records. An address list can be printed for generating mass fund-raising mailings. (This list can be manipulated with Word Perfect.) You are also able to print donor address labels and summarized donor lists with the program.

Fixed Assets/Depreciation

Accounting for a nonprofit organization's fixed assets has been the subject of some controversy. Some organizations expense the entire cost of an asset in the year it was purchased. Others leave fixed assets on the balance sheet at cost, forever. Now, depreciation accounting, much the same as that used by commercial enterprises, is generally accepted by many nonprofit entities.

PC-FUND's fixed assets/depreciation module gives you on-line access to fixed-asset cost, location, and purchase information. Depreciation computations and subsequent posting to the general ledger are optional. Depreciation can be computed on a monthly, quarterly, or annual basis, whichever is most suitable.

Five standard reports are included with the package giving you necessary audit trail and transaction listings as well as informative summaries of the fixed assets you have on file.

Other Government Systems

As you will notice in Figure 1, AFI has developed a number of other government

Figure 5: The accounts receivable module provides a full complement of standard reports. Additional reports can be produced using PC-FUND's data selection and sort sequencing functions. The parameters of these functions are defined by the user.

systems for municipalities. Only the *Clerk Voter Registration System* is currently implemented on the PC. The other applications, which are currently available in Data General minicomputer versions, may be implemented on the PC when mass-storage devices that can properly support such applications are available to the general PC-owning public.

Documentation

AFI's manuals are printed on 8½- by 11-inch paper and are spiral bound—not the more usual 3-ring hardcover style. The largest volumes are nearly 1½ inches thick and could be a bit intimidating at first. However, once you get familiar with them, it's relatively easy to find answers to your questions.

Conclusion

PC-FUND is quite a heavyweight system for a microcomputer. It is packed with functions and flexibility—with under-

> The donor receipts module can be useful for an organization that does a lot of fund raising and needs to keep information about its contributors on file.

standable trade-offs with respect to ease of use and installation. The support, training, and assistance that AFI offers is a major benefit.

If you are looking for a system that addresses the special accounting requirements of small, nonprofit organizations, you would certainly be well advised to take a long, hard look at American Fundware's *PC-FUND*.

—Michael A. Yesko, Christopher W. Buttine, and G. William Dauphinais

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Business Accounting Software Comes of Age?

Over the past year, Price Waterhouse has reviewed over a dozen accounting products, from the sophisticated to the simple: some for distributors, others for retailers, even one for a manufacturer. Before we begin our second year, we wanted to take stock of what we've seen and venture to predict where PC-based accounting systems are heading.

First, the market is maturing. The evidence shows that some vendors are now delivering the third and fourth editions of their products. A few offer several different product *families* aimed at different market segments or at companies of different sizes. For example, Peachtree pitches its Business Accounting series to businesses with relatively complex accounting needs, its Peachpak 4 system to those with intermediate accounting requirements, and its Back to Basics package to the smallest businesses.

Ten to fifteen accounting packages have achieved national prominence through healthy ad budgets, extensive dealer support, and splashy promotion at COMDEX, the twice-yearly personal computer industry show. However, unlike the spreadsheet or database markets, which are dominated by one or two super programs or families of programs, the market for accounting software is dominated by no single product. Some, perhaps many, of the vendors out there are doomed. In fact, MAI, a vendor of some prominence in the minicomputer market, has already decided to retreat. In Novem-

ber 1984, the company handed over the rights to its PC-based software to a group called Promark, Ltd., which will continue to sell and support the products. Further, we understand that Prentice-Hall has stepped back from its original ambitious plan. The big publishing company offers only the general accounting module from its Profit Center set of packages originally announced.

But, the market suffers no shortage of PC-based accounting software. We count over 60 different series of integrated accounting products in our library of accounting systems—and these are just a portion of what's available. New entrants come onto the market each week. Most consist of at least three separate, but integrated, accounting modules (general ledger, accounts payable, accounts receivable, and others).

Prices Down, Complexity Up

We've been impressed by much of the software we have reviewed. Some of these systems are surprisingly functional. Indeed, several products rival minicomputer software in the range of features and functions they offer.

Such functionality is even more impressive when you consider the bargain-basement prices for which it can be purchased. You can buy one of the most fully featured systems we reviewed (*EasyBusiness Systems* from Information Unlimited Software [IUS]; see "Six Easy Pieces: Accounting Packages from IUS," *PC Magazine*, Volume 3 Number 8) for as little as $300 per module. Not impressed?

PC G/L, a surprisingly complete, small-business bookkeeping system, is part of the growing body of software available for the asking. That's right—it's free, though the authors do encourage a $50 contribution. Many systems represent an incredible value, particularly to those of us who are familiar with comparable minicomputer software that sells for up to $5,000.

Unfortunately, low-cost functionality does not always come free of problems. Implementing these systems can require a great deal of aggravating effort: organizing accounting records, structuring a chart of accounts, entering "start-up" data. Some users, pleased by the price, don't anticipate the cost in time and resources.

Fortunately, the systems we've reviewed to date have been relatively bug-free. The major complaint focuses on documentation, which can be confusing, misleading, or worse, wrong. Some because it's out of date. Still, of the accounting packages we've reviewed so far, only one sent our system off to never-neverland, from where we were able to retrieve it with a reincarnating Ctr-Alt-Del.

The past year has shown us that accounting systems for the PC are full of compromises. A package that tries to cover too broad a market can become hopelessly ineffective if it forces you to fight through irrelevant options and features. But a system can be so simplistic that it doesn't address your real-world accounting needs. Unfortunately, sophistication breeds complexity. (Modern spreadsheets may be the exception.) Your best bet is to invest in a package that offers only the fea-

tures your business requires.

Another caution: While there's a good chance that you can find a suitable "financial" application system (for general ledger, accounts payable, accounts receivable, and payroll), the likelihood of finding an appropriate package for "operating" applications (sales order entry, inventory, job costing) is small because these systems are so specialized. Your particular "operating" system probably reflects your particular industry and your specific management style. For example, in a sales order management application, the odds are slim that your program of choice includes everything you need in pricing flexibility, back-order processing, item substitution capabilities, and so forth. Many companies circumvent this limitation by using one program or set of programs to address their basic accounting needs and building other small "operating" systems for several separate database and spreadsheet programs.

Probably the biggest single deficiency in the PC-based accounting systems we've reviewed is the absence of effective cash management modules. Day-to-day cash management is important to most small

> PC Magazine's accounting experts, like accountants everywhere, could not repress the instinct to turn in an annual report. There's good news and bad news (but mostly good news).

businesses. Yet few programs have addressed this need. The *Business Pulse Report* in the *One-Write Plus* package (see "One-Write Plus: Variations on an Accounting Classic," *PC Magazine*, Volume 4 Number 8) is a beginning.

Program designers should also make more creative use of windowing and multitasking. Often, when using a given accounting function, you need access to another separate function or to a DOS command. For example, say you're entering orders, only to find that the customer's name has not been entered in your master file. With most packages, you probably

have to exit the function you're in to add the customer to the master file. Wouldn't it be nice to be able to "pop up" a window, access the add-new-customer routine, and close the window without ever leaving the function you were in to begin with? The new *EasyPlus* from IUS has some promising features of this kind. And certainly *TopView* (or its "workalikes") should address some of these needs.

Encouraging Trends

We've observed some very interesting and positive trends in the past year's new software. Not just improving, accounting programs are beginning to realistically address the problems associated with single-user software. PCs are personal systems. This is great for spreadsheet work, but it can make life difficult when it comes to handling the accounting chores for a growing business.

A common complaint from those who use PC-based accounting programs is that they do not allow more than one person to gain access to the data files at the same time. While some multiuser and LAN-based systems have already emerged, the coming year will see the introduction of

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more multiuser accounting systems. Probably the greatest number will be offered for use with IBM's on the AT or in connection with IBM's new local area network.

A second common complaint is that accounting systems make it too difficult to export data to spreadsheets and databases. Some systems allow you to create standard DOS ASCII files containing some of your accounting information. But many allow you to export only a limited set of the data. Few of the packages we've reviewed go far enough in this regard, but we see improvement in the next year.

Another positive trend is the growing number of "vertical" products. Accounting software vendors are now catering to the specialized needs of specific industries. For example, most of the inventory accounting packages for the PC today address only the needs of a typical single-location, wholesale parts distributor. This orientation is natural. There are so many such distributors they make an attractive target market. Soon, however, there will be more inventory accounting packages that meet the more specialized needs of, say, bulk distributors, multilocation distributors, or businesses requiring a complex inventory-item numbering scheme (such as the lumber or clothing industry).

The bottom line is that some real cost-performance bargains can be had if you're in the market for a PC-based accounting package. And things are getting better every week. Chances are good that your small business could benefit from one of the available financial packages. However, for those applications unique to your industry, you may have to wait until you develop the appropriate software yourself.

—G. William Dauphinais and Michael A. Yesko

If you have a suggestion or a comment about any package, please drop a line to:

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And the Winners Are . . .

The requirements of business accounting software are too varied to award a "Best of Show" prize. But some programs feature elegant solutions to standard problems and deserve special recognition.

Functionality, flexibility, and friendliness: These are the features we look for when evaluating accounting software. No program does it all, but the packages below are exemplary for one reason or another. Ladies and gentlemen, the Price Waterhouse Hall of Fame.

BOOKS!'s Technique of Scrolling to the Correct Account eliminates entirely the account code (and vendor and customer codes as well) by allowing you to scroll to the correct account in a window. Better yet, as you begin typing the letters of the account name, the program matches, one-by-one, the leading letters of your account titles—until you arrive at the right account, which you can then select by hitting Enter.

BOOKS!'s Predefined Charts of Accounts consists of ten different charts for each of ten types of businesses, making it much easier to get started.

BOOKS!'s Transaction Annotation Facility allows you to affix a 72-character, free-form note to each transaction. This helps restore one of the things people miss most after shifting from a manual to an automated system: the ability to annotate transactions freely. Computer systems seldom allow you to "jot down" notes or comments that may help you understand later what you recorded. For example, say you receive $20 back from an employee after a business trip and are not quite sure how to record the transaction. Using a manual system, you would have no problem scrawling a note in the records to the bookkeeper, clarifying what had occurred. Not so with most automated systems. So hail this thoughtful touch from BOOKS!. (See "Electrify Your Ledger with BOOKS!" *PC Magazine*, Volume 3 Number 9.)

Rags-to-Riches's Single-Character Account Coding Scheme wins the prize for simplicity and function in the Very Small Business category. It's tough to top *Rags's* use of a single character to represent each financial account number. If you can't remember the proper account code when entering transactions, you can literally let your fingers do the walking—across the keyboard—until you find the right account. That's neat! (See "Accounting for Individual Tastes," *PC Magazine*, Volume 4 Number 4.)

Visual Presentation of One-Write Plus, another "low-end" accounting package, did the best job of employing visually pleasing and useful screen formats. For example, the screen used to capture cash-disbursement information appears exactly like the check and check stub that you would otherwise be writing across the keyboard—until you find the right account. Now that's friendly. (See "One-Write Plus: Variations on an Accounting Classic," *PC Magazine*, Volume 4 Number 8.)

The Powerful Report Writers from IUS and Solomon III are good tools if you want to custom-design your financial reports. For a report on Solomon III, see "Getting Wise with Solomon" (*PC Magazine*, Volume 4 Number 2).

PC-FUND's Extensive Budgeting Facilities, starting with the production of budget worksheets, was best in helping create and maintain a budget for your operations. (See "Nonprofit Accounting with PC-FUND", page 138 in this issue.)

IUS Transaction Audit Trail Listings did the best job of creating a clear audit trail between the subsidiary systems and the general ledger. Transaction listings

produced by the subsidiary systems include a clear reporting of the financial amounts flowing into the general ledger, as a "trailer" at the end of the report. (See "Six Easy Pieces: Accounting Packages from IUS," *PC Magazine*, Volume 3 Number 8.)

MAI/Basic Four's Automatic Allocation Function provides real help in establishing and processing "standard" monthly allocating journal entries. You are allowed to establish a "from" account and one or more "to" accounts. The system will then automatically clear (zero) the "from" account, applying the amount in it to the "to" accounts (based upon percentages you establish). (See "Sizing Up the Basic Four," *PC Magazine*, Volume 3 Number 21.)

Dow Jones's Account Summarization and Reporting Structure lacks a report writer but has a very useful facility to create an account hierarchy that dictates how your detail accounts are summarized and reported. An example:

```
0705 Telephone Expense
   0705.1 Telephone Expense
           (Marketing Dept.)
   0705.11 Basic Charge
   0705.12 Long Distance — AT&T
   0705.13 Long Distance
           GTE/Sprint
```

The Dow Jones Report and Screen Clarity of Design was the best we observed. They effectively employ the indented account structure described above, which results in clean, understandable screen formats and easy-to-follow reports. (See "Dow Jones Does the Books," *PC Magazine*, Volume 4 Number 6.)—**G. William Dauphinais and Michael A. Yesko.**

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AFTER SMARTERM, WHAT DO YOU DO WITH YOUR OBSOLETE TERMINAL?

Word Takes Another Forward Stride

Microsoft Word has always been a frontrunner in supporting innovative hardware. The new Word 2.0 continues this tradition, and it is also easy to learn and grow into.

A quiet revolution is occurring in word processing technology that will have a significant effect in offices over the next few years. New developments that improve output quality and increase efficiency will make software that lags behind obsolete. One such development is the laser printer, which offers fast, quiet printing that comes close to matching the high quality of typeset copy. Although laser printers have been around for several years, their price has recently dropped from over $10,000 to under $4,000. Another development is the more widespread use of the mouse as a keyboard alternative. A mouse can speed editing by reducing the keystrokes needed to execute menu commands. It can also reduce learning time for new users. In the past, many have resisted mouse technology because to use it their hands must leave the keyboard. The mouse, however, is an increasingly popular alternative.

Microsoft Word was one of the first packages to take full advantage of both laser printing and mouse technologies. It was ahead of its time when first released in November 1983, and many users found it a bit intimidating. With its release of *Word* Version 2.0, Microsoft has taken a further

step in the right direction. While the program still has room for improvement, its excellent instruction disk, new documentation, expanded *Spell* dictionary, and support for the newest and most advanced hardware make this latest release of *Word* a more appealing product for a wider base of users.

Learning Word

When *Word* was first released, many critics complained that it was difficult to

grasp and that its documentation was inadequate. Microsoft has given the manual a complete facelift for Version 2.0, starting with a change in the color of its packaging from somber dark green to a more pleasant red and gray. The manual includes a two-sided plastic keyboard template that shows commands for both keyboard and mouse. This brand-new manual, with its colorful illustrations, is much more accessible. It includes both a supplement to the previously released, on-disk tutorial and an in-

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depth reference section on commands and features.

First released in October of 1984, the Learning Word disk tutorial is one of the best we've seen. It employs instructional methods users respond well to, according to product analyses. The tutorial also makes good use of graphics to heighten and maintain user interest (See Figure 1). The tutorial takes about 3 to 4 hours to complete.

Each learning module begins with an outline of the subject matter, then a demonstration of the feature or command, followed by practice and review. You can follow lessons in order or jump around as you wish. When we sat a complete novice at the keyboard with Learning Word, he was making simple edits in less than an hour.

Better Spelling

Another feature that has been enhanced in Version 2.0 is Microsoft's spelling checker, Spell, which was first introduced with *Word 1.5* in October 1984. Spell has always been an excellent program, but this new release includes two major advances. The standard dictionary now contains over 80,000 words, and Spell now runs directly from the *Word* menu.

The original Spell used a dictionary licensed from Oasis Systems, the developer of *Word Plus*, but the new version's dictionary was created especially for Microsoft. It includes many more prefixes, suffixes, derived words, and proper names such as states, cities, countries, and companies, according to a Microsoft spokesman.

When you choose the Spell option from the *Word* menu, the program then prompts you to insert the Spell disk. Spell first saves the file you've been working on,

PC RATED

Microsoft Word, Version 2.0
Microsoft Corporation
10700 Northup Way
Bellevue, WA 98009
(206) 828-8080
List price: $375
Requires: 256K RAM, DOS 2.0 or higher, two double-sided disk drives or a hard disk.
CIRCLE 688 ON READER SERVICE CARD

Figure 1: *The* Learning Word *on-screen tutorial is an excellent introduction to the program and can help you get up to full speed.*

Figure 2: *Microsoft* Spell *displays the text in which a spelling error occurs and suggests the correct spelling as well.*

Figures 3 and 4: Word's menus and text windows look sharp when displayed on an IBM Enhanced Color Display with an IBM Enhanced Graphics Adapter Card.

then reads the file, and then reads the dictionary to check the spelling. When this process is completed, Spell reports back to you how many words were checked and how many "unknown" words it found. For each "unknown" word, Spell shows you the spelling as it occured in your document and the text of the line in which the word occurs (see Figure 2). You can correct the word either by typing in the correct spelling or by using the arrow keys to choose from a list showing the correct spelling of the word or similar words. You can also choose to ignore the word and go on to the next one or to add the word to either the program's standard dictionary or your own dictionary.

Spell has five additional programs that can be run either directly from within Word or invoked from DOS. The Lookup program will check for the correct spelling

> The Learning Word tutorial is one of the best we've seen. When we sat a complete novice at the keyboard, he was making simple edits in less than an hour.

of one specific word, saving the time involved in looking through the entire dictionary. Word Count counts the number of words in a document. Word Frequency counts the number of times each word is used in a document and lists the total number of words and the number of unique words. A separate file lists how many times each word is used.

Anagram lists all the words from Spell's 80,000 word dictionary that can be derived from a series of letters. You can even enter DOS wild card characters; for example, entering f??s will yield a list of 25 words that can be made from any combination of these letters, including soft, fast, figs, and so forth. Word Find can be used to create a list of words that fit a certain word pattern. For example, entering an*ism will yield a list that includes anachronism and anglicanism.

The new version's exemplary hardware

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Discover what 50,000

support is evidence of Microsoft's continued commitment to keeping up with the newest technology on the market. It has long been true in the personal computer industry that software support lags behind the introduction of innovative hardware, which then may remain unused by all save those with advanced programming capabilities. Not so with Microsoft products. While other software developers will eventually catch up, the important point is that *Word* supports these products *now*.

What products? *Word* 2.0 supports the IBM Enhanced Graphics Adapter Card, the IBM Enhanced Color Display monitor, the high-resolution Hercules Graphics card, and the Intel 80286 processor used in the IBM PC AT. *Word*'s formats, includ-

> It has long been true in the PC industry that software support trails innovative hardware. Not so with Microsoft. While other developers will eventually catch up, Word supports these products now.

ing its small capitals, double underlining, and super- and subscripts, look outstanding on high-resolution graphics hardware (See Figures 3 and 4). Documents may be viewed on-screen almost exactly as they will appear when printed out.

Word 2.0's support of new printer technology, especially laser technology, is astounding. The new version supports IBM's thermal transfer printer, the Quietwriter, as well as the higher-priced Xerox 2700 laser printer. Documents printed out on a Hewlett-Packard LaserJet using *Word* are of very high quality; *Word*'s special character formats look wonderful when output on the LaserJet (See Figure 5).

Word 2.0 also supports Apple Computer's new LaserWriter printer. The LaserWriter connects to the PC's serial port, and when you install the appropriate driver with *Word*'s easy-to-use Setup program, a

---

Example 2

BLACK SKI COMPANY

DEALER PRICE LIST
Listed prices are effective as of May 21, 1984

	SUGGESTED RETAIL PRICE	DEALER PRICE 1	DEALER PRICE 2
Standard Thirteen sizes from 140 to 218 cm. Black top, sidewalls and bottom; white engraving.	$115.00	$ 86.25	$ 80.50
Master Nine sizes from 175 to 218cm. Black top and sidewalls; blue base and engraving.	$135.00	$101.25	$ 94.50
The Fabulous 360 Eleven sizes from 170 to 230 cm. Black top and sidewalls; yellow base and engraving.	$155.00	$116.25	$108.50
Slalom Five sizes from 190 to 210 cm. Black top and sidewalls; racing red base and engraving.	$160.00	$120.00	$112.00
Downhill Seven sizes from 195 to 225 cm. Black top and sidewalls; yellow base and engraving.	$175.00	$131.75	$122.50

Printed on the Hewlett-Packard LaserJet printer using Microsoft Word.

Figure 5: *Word fully supports the Hewlett-Packard LaserJet printer. This sample uses the proportional spacing font cartridge.*

PC can drive this powerful printer. The LaserWriter produces true Times Roman and Helvetica fonts, as well as supporting Macintosh graphics (See Figure 6).

Make New Friends

In addition to these major improvements, Version 2.0 has added a few other goodies. For example, in the new version you can run DOS commands such as CHKDSK and FORMAT without exiting *Word*. When you select the Library Run command, *Word* prompts you for the DOS command and allows you to insert the appropriate DOS disk.

Another new feature is a hyphenation program, which boasts up to 98.9% accuracy in deciding where a word should be hyphenated. You can let the program do all the hyphenation for you, or you can choose to confirm each hyphenation decision. We justified this article after it was written and let *Word* hyphenate the text for us. The results were good; the program made only one error.

Word 2.0 allows you to use the entire screen for editing. You can turn off the command lines at the bottom of the screen by using the Option Menu command. *Word* 2.0 also lets you confirm its automatic placement of page breaks. You can

I fell 20,000 feet and lived.

There I was flying Microsoft® Flight Simulator over Chicago's O'Hare Airport, having the time of my life. Suddenly my carburetor started icing. My RPMs started falling. My altimeter spun backwards. The Sears Tower loomed ahead.

I was behind the controls of a Cessna 182. As an experienced Microsoft pilot, I had taken off and landed at 80 different airports. Created different flying challenges (using my Microsoft Mouse and my joysticks). Altered the weather, time and season. Even flown the World War I dogfight mode and successfully battled enemy aircraft.

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MICROSOFT.
The High Performance Software

Microsoft Word for the IBM PC
and the Apple LaserWriter

```
This paragraph demonstrates the courier font. It is a fixed
pitch font. This is bold courier. This is italic courier.
This is 10 point courier. This is 12 point courier (with
bold).
```

This paragraph demonstrates the Times Roman font in 12 point size. It is a proportional spaced font. This text is 10 point. This 10 point Times Roman would be ideal for multiple column printing, such as a newsletter. This is the same font and size in bold. *This is the same font in a 12 point size and italic.* The last Times Roman font is 8 point. It is very small and can be used for footnotes and fine print.

The Helvetica font is useful for headings and titles. The top line on this page is 24 point. The second line is 18 point and this paragraph is 12 point. **This is bold helvetica.** *This is italic helvetica.*

Figure 6: *Word is the first PC-based word processor to support Apple Computer's LaserWrite printer.*

use the arrow keys to change the location of a break to shorter pages.

But Keep the Old

These many improvements have not changed *Word's* basic operation and approach to word processing, which has always been unique. Besides the standard features you'd expect from a good word processing package and such extras as a mail-merge facility, the program retains its use of multiple windows, full mouse support, the useful "undo" command, macro-like facilities, and a wide variety of formatting options. The majority of these familiar features have not been changed in the new version, although a few have been enhanced.

One aspect that has not been improved in *Word* 2.0 is its speed in loading and in saving files. Although the rest of the program's operation is speedy enough, these operations seem to take an excessively long time, especially on a two-floppy disk drive system.

Word still offers some of the most powerful windowing features of any word processing product for the PC. You can open up to eight windows on the screen at once; each window can contain a different file (see Figure 7.) Of course, two open windows is usually enough for most purposes. The ability to move or copy blocks of text from one file to another on-screen is ex-

tremely convenient.

However, in the new *Word* version, both headers and footers must still be entered as part of the text and then marked appropriately—a separate window for headers and footers would make this feature easier to use.

The original release of *Word* was ahead of its time in its inclusion of two powerful macro facilities. The first, "style sheets," enables you to assign even a complex format to any Alt-character key combination, then use that combination to format selected text. Each style sheet acts as a kind of print filter or template that can be accessed with a few keystrokes and applied to different blocks of text.

In *Word* 2.0, Microsoft has added five prepared style sheets—two for letters, two for outlines, and one for a memo—adapted from its recent book of style sheets, *Word Processing with Style* by Peter Rinearson, soon to be published by Microsoft Press.

The second macro facility, "glossaries," has not been changed. "Glossaries" lets you select any section of text and assign a name to it. If you forget the glossary name later, *Word* will show a list of names to choose from. While the glossary is a handy feature, it is not as useful as some of the keyboard macro programs on the market; it requires more keystrokes and cannot include commands. A *Word* glossary requires a minimum of four key-

strokes to *ProKey's* two, for example. And you can't include print and save commands in a glossary the way you can in a *ProKey* macro. (On the other hand, *ProKey* won't let you easily view a list of your macros from within most programs.) Perhaps Microsoft will correct the glossary's deficiencies in the next *Word* release.

One of the original *Word's* most advanced and admirable features was its complete support of a mouse. *Word* 2.0's mouse interface has not changed, and it is still a perfectly acceptable implementation. However, the program's mouse response no longer impresses us as much as it once did. In comparison with the Macintosh's mouse interface, it seems a bit mushy and imprecise—the cursor does not

> *Word* offers some of the most powerful windowing features of any word processing product for the PC. You can open up to eight windows on the screen at once, and each window can contain a different file.

track mouse movements as exactly as it might, and it leaves a sort of ghostly trail on the screen at times. The difference is hard to pin down—it's not so much a matter of speed, but of handling, rather like the difference between steering a BMW and a Chevrolet.

For the Future

On the whole, *Word* 2.0 is a big improvement over its predecessors. It has made *Word* a program that is not only sophisticated and powerful, but one that is easy to learn and grow into. More than that, the new version's terrific hardware support demonstrates Microsoft's commitment to the word processing revolution that is giving many offices a true in-house publication facility. At this writing, Microsoft is preparing to announce a new typesetting interface for *Word* tentatively titled Linoword. This interface will link

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WORD

Figure 7: A Word display showing multiple windows.

Park officials track grizzlies with automated system

MAMMOTH HOT SPRINGS, WYOMING — In the 2.2 million acres of Yellowstone National Park, park officials are using a computer program to track the movement of some 200 grizzly bears.

The park uses its Datapoint Corp. 8030 minicomputer and a software program developed in-house to gather information on the behavior of the park's grizzlies. Known as the Bear Management Program, or more recently, the Wildlife Tracking Program, the system allows park officials to check on behavior patterns and provide area rangers with information on bear sightings and related incidents.

This year, an increase in the number of bear attacks on humans has kept park officials busy providing information through the management system, noted Sandy Fowler, park technician. There have been at least four bear-related injuries this year. In July, a bear attacked and killed a 25-year-old Swedish woman backpacking in the wilderness. A few weeks later, a 12-year-old boy was attacked while sleeping in a densely populated park campground.

Using computers to provide better bear management is not a new concept. A system similar to the one used at Yellowstone was first used at Glacier National Park in Helena, Montana, and was later made available to all

national parks in 1978 according to John Dennis, supervisory biologist at the National Park Service in Washington, D.C.

The system, known as the Bear Information Management System (Bims), was serviced by Boeing Computer Services Co. and allowed six national parks to develop a data base on the bears in their parks.

But a number of problems with the Bims system and the increased efficiency of letting individual parks access data of their own computer systems kept clear caused the government to take Bims off-line.

Richard Racpchuh, chief of the division of natural resources at Yosemite National Park in California, said that with Bims, it often took too long to retrieve information. The system was also down frequently, he said.

"Every park had different needs," he added. "Bims was designed to help everybody, and helping every body was asking too much of a computer program."

Figure 8: Used as a front end for Allied Linotype's Linotronic 101 typesetter, Word produces camera-ready copy.

personal computers running Word to Allied Linotype's Linotronic 101 laser typesetter, a low-end machine that produces characters with a 1,440 lines-per-inch resolution. With the new interface, typesetting can be done at the word processing level, eliminating the need to insert elaborate code codes (see Figure 8).

It's high time other software developers joined the revolution instead of hanging back on the sidelines with less-than-state-of-the-art programs. Word may not be word perfect, but it's in the vanguard. ■

Diane Burns and S. Venit are frequent contributors to PC Magazine.

PRINTOUTS TH

Take a close look at Canon's line of printers. The first thing you'll notice is how good they make you look.

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Mainframe
Financial Modeling
Comes to the
Micro

IFPS/Personal goes far beyond the capabilities of most spreadsheet products with its sophisticated features ported from the popular mainframe version.

Execucom's *IFPS/Personal* is a sophisticated financial modeling system that may find admirers among two very different groups: financial planners who currently use the mainframe version, *Interactive Financial Planning System*, and those now struggling along with a microcomputer spreadsheet program.

If you use the popular mainframe program, you may be looking for a way to integrate micros into your decision support system, enabling planners to enjoy a PC's advantages while retaining the ability to share information and coordinate results. *IFPS/Personal* can be this link. It allows you to extract information from a mainframe running *IFPS*, work with it on the PC, and then return the results and individual models to the mainframe. Your organization can control access to models and data on the central computer while allowing each planner to first interrogate the mainframe and then change model assumptions on a PC.

If you're a spreadsheet user, on the other hand, you may be finding spreadsheets inadequate for the kind of sophisticated planning and modeling you'd like to do. For goal seeking or creating models that require simultaneous equations, spreadsheets can be frustrating, if not totally inadequate to the task. And you can't easily use them to save base-case models or to share and maintain models, because they don't describe business problems in readily understandable terms. *IFPS/Personal* may be the sophisticated standalone

system you need. It will enable you to do such calculations as accelerated cost recovery, depreciation, goal seeking, internal rate of return, loan amortization, net present value, loss carry-forward, and simultaneous equations. And it lets you consolidate multiple worksheets.

You can direct the program to manipulate a matrix of data, perform interactive "what if" analyses, and create reports and graphs from the results using either commands or a hierarchy of menus. For quick debugging and case analysis, a split screen displays both the model result and the logic that was used to generate it (see Figure 1). *IFPS/Personal* uses a nonprocedural language that allows you to specify rules and model logic in any order you choose. The program constructs the model from all available information.

From Mainframe to Micro

Execucom originally envisioned *IFPS/Personal* as an extension of its mainframe product and, for the first release in November 1983, made it available to *IFPS* users at a price of $3,500 per copy or $20,000 per copy. In January 1984, the company began volume shipments, dropping the price to $3,000 per copy. In response to demand from non-*IFPS* users, Execucom has now shifted its marketing strategy to embrace those looking for a standalone microcomputer product. It has halved the price—to $1,500, or as little as $475 with volume discounts—and put out a $20 demo disk whose price is applicable to the product's purchase.

IFPS/Personal comes equipped with a communications feature that allows you to upload and download your model to and from the mainframe version of *IFPS*. The up- and downloading process does require

Figure 1: *As you create the model's logic, the program converts it to a spreadsheet format that appears above in a separate window.*

Figure 2: *In this split screen, the program is set up for goal seeking.*

translation, since the commands for both products are not completely the same, but the execution time is relatively short. The mainframe *IFPS* has a number of utilities that allow you to work with various general ledger, database, and statistical packages.

IFPS/Personal is not difficult for spreadsheet users to learn because at its core is a spreadsheet representation of data. However, you do not begin in spreadsheet mode; you first enter the model's logic in the program's English-like language, and the program converts this

logic, as you create it, to a spreadsheet format that appears in a window above. You can then use the spreadsheet for doing case analysis.

As you can see in Figure 1, the language in which you enter model assumptions and formulas is fairly simple, as in Revenues = Price * Units Sold or Cash Collections = 60% * Revenues. (The asterisk indicates multiplication.)

When creating and modifying the model logic, you use *IFPS/Personal's* full-screen editor, which offers such traditional commands as add, change, delete, and replace. The program automatically numbers each line for you; almost all the commands can reference the line numbers. A "logging" function records your keystrokes and creates an execution, or EXEC file. The EXEC file is rather like a macro or batch file that records your commands for later use. You can then use this EXEC logic file to automate such repetitive processes as consolidating files and testing alternatives by rerunning the model.

Once you have a logic file, *IFPS/Personal* calculates the model and generates a spreadsheet work area in which you do most of your design and analysis. You enter your data into the spreadsheet's rows and columns, perform calculations, design additional logic and evaluate alternatives. *IFPS/Personal* allows you to build a set of case criteria, calculate and overlay the results in the work area, and then, if you like, save the case criteria in a file separate from the logic. This last capability, to separate the data from the rules, is a crucial difference between *IFPS/Personal* and a spreadsheet; it means you can process many different sets of data with the same model or the same data through many models.

Analytical Capabilities

IFPS/Personal offers you almost the same analytical functions available with the mainframe version. It lets you take such common calculations as internal rate of return, net present value, depreciation, and loss carry-forward a step further than you can with a spreadsheet. For example, you can specify any one of a number of depreciation methods or add a midterm cash flow parameter to an internal rate of return calculation. All you do is select parameters for the formulas, which are built into the

IFPS vs. ENCORE!
How does IFPS/Personal stack up against its major competitor, Ferox Microsystems's ENCORE!?

In reviewing financial modeling software for the PC, *IFPS/Personal* 2.0 and Ferox Microsystems's *ENCORE!* 2.0 stand out among products designed to aid the planner. A choice between these two quality products is very difficult. In comparing the two products it becomes obvious that the key differences between them are different user interface styles and price (see "New Power for Constructing Financial Models," *PC*, Volume 3 Number 15).

While *IFPS/Personal* originally cost $3,500 per copy and *ENCORE!* $695, the price difference between them is less dramatic than it once was. As of April 15, the price of *ENCORE!* rose to $895, while the price of *IFPS/Personal* is now only $1,500. If you buy in quantity, the cost difference is smaller per unit since Execucom prices *IFPS/Personal* as low as $475 in volume.

The more significant difference between the two products is in their user interface. *ENCORE!* requires a procedural or systematized approach to develop the model, while *IFPS/Personal* uses a non-procedural or interactive approach.

IFPS/Personal's nonprocedural approach lets you develop the model in an interactive session. No knowledge of modeling mechanics is required and the sequence of commands is immaterial. This approach is well-suited to managers who want to concentrate on business as-

sumptions and relationships.

The procedural approach *ENCORE!* uses is best suited to those well acquainted with modeling and willing to work in the structured, planned environment that *ENCORE!* requires. To use this approach, you must understand such things as the sequence of commands and how to solve simultaneous equations. *ENCORE!'s* approach does result, however, in improved documentation of the resulting model, especially when the model will be turned over to an end user.

The recommended configurations for each product are substantially different. *IFPS/Personal* requires a minimum of 512K memory and a graphics display adapter and monitor whereas *ENCORE!* requires 384K RAM and uses the monochrome monitor and adapter for both text and graphics displays. Obviously, if you need to upgrade your equipment to run *IFPS/Personal*, it would be a substantial investment. Those who already have at least 512K and a color monitor will find that *IFPS/Personal* will make it come alive with three-dimensional color bar charts. While not required for graphics output, *ENCORE!* can drive a plotter to produce high-quality graphs. Both products can drive the common dot matrix printers for draft-quality graphs.

Although both programs include most of the features necessary for financial modeling, *ENCORE!* has several potentially significant features not yet available in *IFPS/Personal*: linear regression, sorting, and the current U.S. tax tables.

One feature the two products both have is better implemented in *ENCORE!* A well-documented and easy-to-use consolidation feature in *ENCORE!* allows you to add, subtract, multiply, and divide one matrix with another. While *IFPS/Personal* also allows matrix consolidation, the feature is not as flexible or well documented.

The choice is yours. — *Ken Edwards*

language. You can specify the number of iterations for each calculation or the tolerances within which the results must fall. The only two mainframe version features not ported to the micro version are Monte Carlo simulations and universal consolidation.

However, *IFPS/Personal* does offer rather sophisticated consolidation features. This consolidation capability is crucial to large-scale corporate planning and modeling, since the models and results for different divisions and subsidiaries must be brought together to create the overall corporate plan.

One of the most useful features of *IFPS/Personal* is its ability to solve simultaneous equations. A relatively simple

> IFPS/Personal offers almost the same analytical functions as the mainframe version. The only two not ported to the micro version are Monte Carlo simulations and universal consolidation.

problem, calculating a chief executive's bonus as a percentage of the company's after-tax income is complicated by the necessity to deduct that bonus from the taxable income before you can find out what the after-tax income will be. Such a circular calculation would make smoke come out of your spreadsheet but *IFPS/Personal* can handle it with ease. You don't even have to tell it that this combination of formulas represents a simultaneous equation; it will recognize the problem and solve it automatically.

Goal seeking is one of the most sophisticated features available in modeling; basically, it is like sensitivity analysis in reverse. Instead of testing an independent variable to see the effect on the dependent variable, you can set the dependent variable to the desired value and have the program calculate the value of the independent variable. *IFPS/Personal* offers a single-variable goal-seeking feature in the spreadsheet mode and allows you to adjust

the number of iterations and the convergence tolerance.

For example, In Figure 2, the goal is set in the bottom window to realize revenues of $15,000 in January, with a 5 percent monthly revenue growth rate. I have specified that the independent variable, price,

Figure 3: *A report listing for a data file containing the Western Division's yearly totals. The data is stored separately from the model.*

Figure 4: *IFPS/Personal created this chart from first-quarter cash flow figures.*

should be adjusted to reach this revenue goal.

The Presentation

Reporting is almost as important as analysis, since it is the primary means of communicating the mode's results. *IFPS-*

Figure 5: A model and spreadsheet for analyzing total cash disbursements.

Figure 6: The cash disbursement totals in report format.

Personal has an interactive report formatting utility that saves the reports as separate files. You can select blocks of data for display, dress up the data using the standard formatting options, and rearrange or reorder the model's rows and columns. Figure 3 shows a report drawn from a sample data file. You can also enhance your presenta-

tion with graphics. *IFPS/Personal* has an automatic graphing function that will produce scaled, colored charts from your data. You can select the variables you want graphed, starting and ending points, and other parameters. The program will produce pie charts, line charts, and four types of bar charts: two-dimensional clustered,

three-di-mensional clustered, stacked, and percent. Figure 4 shows a bar chart. Figures 5, 6, and 7 show the same information as a spreadsheet, a report, and a pie chart.

Unfortunately, although it supports several popular dot matrix printers, including the IBM four-color dot matrix, the program does not support any pen plotters. You can, however, buy an optional program, *Sidelight*, that enables *IFPS/Personal* to support the Hewlett-Packard 7470 two-pen plotter.

Utilities

IFPS/Personal includes several useful utilities that let you copy data files for later use or display them for scanning. You can redefine the PC's function keys either for the duration of the modeling session or for permanent use in the program. Conveniently, *IFPS/Personal* lets you run other program without exiting, and then return to the model you were working on.

Manual Help

Modeling is not as easy to master as a spreadsheet; good techniques are developed through training and experience. To aid the novice as well as the experienced user, Execucom offers an audio-visual demonstration, a 258-page, 13-lesson tutorial, a comprehensive 529-page reference manual with an index containing both the tutorial and the reference manual, a fold-out 22½- by 37-inch menu hierarchy chart, and context-sensitive help screens at the touch of the F1 key (see Figure 8).

The tutorial is very well organized and clearly written. It will take most office-based users several days to complete but is well worth finishing in its entirety before using the product. Each lesson describes not only what you will do but also the files that you will need.

In order to supplement the training materials, Execucom hosts training classes at its Austin, Texas, education center and in several major cities across the nation. In addition, on-site training classes are available on a contract basis. Included in its Customer Support Plan is one year of hot-line assistance.

Unfortunately, the one thing the lengthy documentation does not include is an explanation of the financial modeling

process, which for first-time users might be essential. For those who need it, a useful reference work is *Financial Model Preparation* by Philip L. Blumenthal, Jr., CPA, published by the American Institute of Certified Public Accountants, New York. Blumenthal includes the following description of the modeling process:

1. Determine the questions the model is to address and the problems that are to be solved.

2. Review the data available.

3. Select, gather, compile, and access specific data.

4. Analyze and test the data to determine relations and interactions and causes and effects. Such analysis should balance statistical methods with manual methods, plotting variables against one another.

5. Lay out a tentative model structure, both variables and relationships.

6. Review the tentative structure with client management and amend as appropriate.

7. Write, code, debug, run, and validate the definitive model.

8. Review the first results with your client and then agree upon alternative assumptions.

9. Rerun.

10. Repeat steps 8 and 9 as required.

11. Analyze results and present conclusions.

12. Prepare explanatory detail and operating instructions, as required by the terms of the engagement.

The Right Tool for the Job

No program, however good, is absolutely perfect. Despite its sophistication, *IFPS/Personal* lacks several features that I would like to see added, including multivariable goal seeking, linear and multiple regression functions, Monte Carlo simulation, and built-in U.S. tax tables. It is also somewhat oversized. In most areas, however, it meets the competition. (See sidebar, "IFPS vs. ENCORE!" for a comparison of *IFPS/Personal* with its leading competitor.)

If you buy a financial modeling package like *IFPS/Personal*, don't throw away your spreadsheet program. For quick analyses that don't require the power of modeling software you will be better served by

Figure 7: *Using the cash disbursement totals, the program has automatically produced a colored pie chart.*

Figure 8: *A context-sensitive help screen explains the main menu choices.*

your spreadsheet. If you think you are going to need the capabilities of modeling software, however, don't frustrate yourself with a spreadsheet product.

If your responsibilities include financial planning, you should definitely consider *IFPS/Personal* or a program like it. You will get the job done faster and get quality results. ∎

Ken Edwards is a manager with the executive office of Touche Ross & Co. He is currently in charge of the firm's microcomputer support center.

Long-Distance Computing at
FULL POWER

Many of you have made substantial investments in hard disks, RAM chips, tape or cartridge backup systems, and other information storage devices. But none of you can be rich enough or strong enough to carry around computers that can process and store all your data everywhere you may roam. Wouldn't it be great if you could couple the storage capacity of your stationary PC with the carry-ability of a portable computer?

Now you can. By assembling readily available hardware and software, you can have storage *and* portability, through remote computing. *Remote*, a software package from Microstuf (the company that has been so successful with *Crosstalk* communications software), gives you full use of your PC when you call in through a modem, just as if you were using the local keyboard and monitor.

Remote configures your system so that the PC thinks that anything coming in through the RS-232 port comes from the keyboard. Conversely, anything the PC sends to its screen goes out through the RS-232 port. Anyone connected to the PC's serial port or modem with any of 32 different terminals or with a portable computer can both make inputs and see what is displayed on the PC's screen just as if the inputs had been made from the PC's keyboard. *Remote* also works with internal modem cards like the Hayes 1200B.

Remote has some limitations, mainly in the display. Sending a screenful of color graphics over a telephone line takes a long time. *Remote* works best with programs running in the PC's

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With Microstuf's Remote, a modem, and some additional hardware and software, you can use your PC from afar as you would at home. Thus you can have the storage capacity of a PC and the portability of a laptop, too.

"text" mode—word processing programs, database programs, BASIC programs, and the like. Although you can run spreadsheets and other programs that address the screen in the graphics mode, the task of repainting the screen makes these programs operate slowly. (You might run into a few other display limitations, discussed later.)

A Fair Exchange

One thing *Remote* does well is exchanging files. If you use *Crosstalk* to call your host PC from your terminal or portable computer, *Remote* can transfer program and text files using automatic error-detection protocols. Since versions of *Crosstalk* are available for many different computers and operating systems, a host computer running *Remote* makes a good file translation device. You can use an 8-bit machine running under CP/M to gain access to your host PC, for example, and then use *Crosstalk* to transfer the file from the terminal to the host. *Remote* can then translate that file into an MS-DOS format for the next caller.

Since the caller has full use of local programs on the host PC, you can run a word processing program, for example, on the

host machine and transmit text files from your local computer using any other communications program. The host PC thinks the characters are being received as input from the host's keyboard and saves them accordingly.

The *Remote* package includes an excellent electronic mail system. It stores and

> Remote has some limitations, especially in the display. Sending a screenful of color graphics over a telephone line takes a long time.

forwards messages, sends delivery receipts, allows instant replies, and has many other features usually found in only the best electronic mail systems. So with one relatively small software investment you can get remote computing, file transfer, and professional electronic mail. The system also gives password protection and personalized sign-on responses for individual users.

Bulletproof

A PC running *Remote* has been my private information utility for several months. At work, a Zenith Z-150 "taps the well" whenever I need to exchange data or get updates from the big system at home. A Radio Shack Model 100 works well as a terminal for *Remote*; I have used mine to call my PC from around the U.S. and a couple of foreign countries. The system has proven to be relatively "bulletproof."

Only one thing bothers me: having to leave the PC running all the time on the chance that I might need to call in. A PC with two hard disks and an expansion cabinet makes an impressive (some might say oppressive) sound in a quiet house. It also heats up the room, not a welcome environmental addition during the summer. (Running the system for 24 hours, however, costs only 50 cents a day.)

TURN-ON

In my search for a way to avoid having to leave the PC on all the time, I experimented with a couple of home-brewed ways to make it turn on in response to a ringing telephone. But my success was limited. I tried using an audio switch that would listen for the phone to ring, but the doorbell, the radio, and people talking also tripped it. I canceled out the idea of using a direct connection to the phone line since that can lead to trouble with the FCC, which regulates all such devices. Finally, after seeing an ad for TURN-ON, a device marketed by Skyland Systems in Scotts Valley, California, I had an answer.

TURN-ON is a talented power controller. For approximately twice the price of a surge suppresser with multiple outlets, TURN-ON gives you a surge suppresser, a power controller that turns on by sensing the switch setting of one of the devices plugged into it, a smart switch that can exchange RS-232 status messages with the computer, and a device that turns on the entire system when the phone rings and shuts it down when the phone is hung up.

The TURN-ON module is pleasing to the eye and well constructed. It comes with manuals that explain all the technical details of the hardware and with a program that has some *Remote*-like functions. The TURN-ON software, however, lacks the multiple passwords, activity log, electronic mail, and other features of Microstuf's program.

TURN-ON works as advertised. I plugged one of my monitors into the outlet labeled Sense and connected the other units in the PC system to the remaining five outlets. When I turned on the monitor's power switch, the whole system came alive. (This procedure is a great improvement over my hunting for six separate switches or stabbing around under the desk with my toe, trying to hit the main switch on my old power control box.)

Routing the phone line to the modem through the AC power control module seemed odd at first, but it worked. On the second ring TURN-ON fed the juice to all its outlets, even when the device that was plugged into the sensing outlet was off. (Obviously, you don't need to have a local monitor on for remote operation.)

Now when the phone rings, the computer comes on. I can dump data and pick up something new anytime, without keeping the system running and adding to the

electric bill. Arousing the PC from a sound sleep, however, proved to be quite another problem.

Slow to Beep

If you've ever waited for an IBM PC with 512K of RAM to run through its power-on memory check, you know that the time from the start of the sound of the fan to the beep can seem like an eternity. The time seems especially long if you are on the calling and listening to the phone ring. The PC takes more than ten rings to run through its memory checks and shake itself awake and another nine rings to run through the AUTOEXEC.BAT cycle, set its clock, boot *Remote*, and present its sign-on menu. (Once the PC gets on the air, the *Remote* software, included in the AUTOEXEC.BAT file, greets you with the *Remote* menu.) Then the modem finally picks up the line, after about 2½ minutes of ringing.

This situation isn't impossible, but it is awkward. Autodialing programs such as *Crosstalk* hang up by the tenth ring, and human patience runs out even earlier. I needed some method of waking up the PC faster.

An auto-answer modem like the Hayes or its clones will answer the phone on the first ring if it senses that the host computer is awake. The host signals the modem using the data terminal ready line in the RS-232 cable. But fooling the modem into thinking the computer is ready by "jumpering" the cable wasn't a good solution since I didn't want to pay just to listen to the modem tone while the machine was waking up.

Some long-distance telephone carriers don't start billing until the called end answers. Some start billing a few seconds after a call is initiated, and whether the phone is ringing, busy, or answered, you pay. So no matter which billing system your carrier uses, you'll want the PC up and running as soon after the first ring as possible.

Quick Booting

One wonderful thing about the PC industry is that someone seems to have thought of an answer to almost every problem. Security Microsystems Consultants makes a product called QUICKON that

forces the PC to bypass its redundant, and nearly always meaningless, memory check in favor of a quick boot of the disk.

QUICKON is a small printed circuit card that is inserted under the main system ROM on the PC's motherboard. The QUICKON package includes the tool you need to remove the ROM. This job isn't

> QUICKON forces the PC to bypass its redundant, and nearly always meaningless, memory check in favor of an automatic quick boot of the disk.

difficult if you exercise a little care. You can install QUICKON in about 5 minutes, and the device can probably save you hours of waiting over the life of the machine.

The PC has another memory parity-checking scheme that is active all the time, and so the chances of a RAM chip suddenly going bad and not being noticed are practically nil. And you can return the power-on memory check to operation by changing a jumper on the QUICKON board.

How Quick is QUICKON?

With QUICKON installed, the PC's beginning beep comes about a second after the machine gets power. If the machine is powered on because TURN-ON detects a phone call, the disk drive starts turning by the third ring. By the fifth ring the AUTOEXEC.BAT file is running, and the machine has set its own clock from an internal multifunction board. *Remote* loads on the sixth ring, and the modem answers the line on the eighth. The process takes about 50 seconds. This delay doesn't waste a paid minute for you long-distance callers who don't have to pay until the phone is answered, gives some security against random callers, and lets you answer the call by voice if you want to.

Details, Caveats

Your success and satisfaction in using this kind of remote data access system will depend to a large degree on the terminal you use to call into the system. Putting data on a screen in anything other than a line-at-a-time format (like that of a typewriter) requires using special codes that control the position of the cursor and other display functions. Reverse video, highlighting, screen clear, and other video characteristics are commanded through special control codes that are received and interpreted by the terminal.

But not all terminals, or microcomputers serving as terminals, understand the same set of screen commands. The host program (in this case *Remote*) must send the right commands to format the screen properly on the distant end so that it looks as much as possible like what appears on the PC's screen.

Remote has a menu of 32 different terminals. It normally associates a caller with one type of terminal, but you can change terminals during the session.

The terminals *Remote* accommodates probably include 90 percent of the commonly used asynchronous terminals (including devices such as the Radio Shack Model 100). But if you want to use a unique terminal device, you should check with Microstuf before you buy *Remote*. If *Remote* can't speak the language of your terminal, you'll get a very strange display on your screen. *Remote* will work with most PC terminal software packages, particularly those that can emulate the DEC VT-100 terminal. But it will only do file transfers using an error-detection protocol with PC's running *Crosstalk*.

Most data terminals have a 24-line display. The PC, however, has a 25-line display, and many programs use the 25th line to show status or a menu. If you are using a PC or a PC-compatible as a terminal, you won't have a problem. But if you are using a machine displaying fewer than 25 lines, you could quite conceivably miss something. *Remote* attempts to help by allowing you to clip off either the top or the bottom line of the 25-line display. You must work with the software you are using on the host PC to determine which line you can afford to lose.

Remote can't help you if the terminal you are using doesn't display 80 columns of characters. Again, you have to work with the applications software in the host

THE EXPERTS SAY...

▲ "...the product did more than the authors said it could do...Compustock is more than any investor will need to do fundamental stock analysis."
—Wall Street Computer Review, March 1985

▲ "Compustock is an excellent fundamental analysis package for the investment community. The software quickly computes crucial ratios, draws graphs and sets target price objectives. In addition to the software the company provides a concise yet clear user's manual."
—Edward Bowman, V.P. Mansfield Chart Service

▲ "The program is entirely menu driven which allows the user to travel freely from one program routine to another. The program makes excellent use of color to highlight various economic conditions and assumptions... the documentation is well written and easy to understand...I think you will find this program to be of value..."
—Computerized Investing Magazine, May/June 1985 (American Association of Individual Investors)

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REMOTE COMPUTING

machine or with horizontal windowing software in your terminal if the terminal has limited display capability.

Finally, some applications programs in the host PC may bypass DOS to paint the characters or images on the screen. According to Microsoft and IBM, this approach is "nonstandard," but some software programs use special routines to address the screen directly for the sake of

> Your success and satisfaction in this kind of remote data access system will depend to a large degree on the terminal you use to call into your system.

speed. These routines bypass the data paths established by *Remote*.

Microstuf has attempted to overcome this problem by giving *Remote* a special "screen mode" of operation. In this mode *Remote* reads the contents of the display screen and sends the caller an image of the screen. Anytime the screen is changed, *Remote* sends only the part of the screen that has changed. If the application program only changes a few digits, this system can work well. But if the program frequently repaints the entire screen, the transmission process can be slow and frustrating.

Using the screen mode, for example, you can run a *1-2-3* spreadsheet on a *Remote* host, efficiently changing numbers and formulas in a single screen and quickly seeing the results. Every time you scroll the spreadsheet in any direction, however, *Remote* has to repaint the entire screen. This repainting takes a couple of seconds, thus reducing the efficiency of the operation. But the added time is a small price to pay for the ability to run *1-2-3* on your home PC while pushing the keys of a small portable in a hotel room a thousand miles away. ■

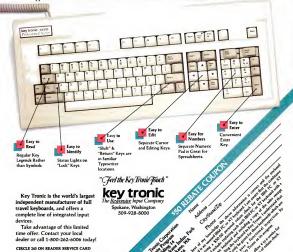*Frank J. Derfler, Jr., is a contributing editor to* PC.

Massive Storage: 120 Fast Megabytes

The DPR-120-FT hard disk subsystem from IDEAssociates pulls together a winning team: a speedy 120-megabyte hard disk, 60-megabyte cartridge tape backup, and versatile software that makes it ideal for networks.

From the looks of the latest add-on hard disk systems, PC suppliers have targeted network users as the biggest market in personal computing—or rather, as the market for the biggest in personal computing. They know that most networks can't get enough megabytes. Consequently, they're launching big new disks with the fanfare normally reserved for battleships.

If you need massive storage capacity, you've got dozens of huge new hard disk systems to choose from. IDEAssociates has now joined the distinguished ranks of the Winchester century club with the IDEAdisk DPR-120-FT, a system that tips the scales at an awe-inspiring 120 megabytes when formatted. However, the new IDEAdisk is no lumbering giant—it's built around one of the speediest 5¼-inch Winchester drives available. To keep that giant friendly rather than fearsome, IDEA has matched the disk with a comparably large measure of security—a full 60-megabyte capacity ¼-inch cartridge tape transport for backup.

Although this pairing is the perfect anchor for your network, you can really plump up your own PC with it too. Be forewarned, however, that this machine is no plaything for the idle keystroker who only wants the best of everything. It's a professional's tool that requires more than a passing knowledge of IBM's scheme of things to put it to best use.

Unimposing Package

From the look of it, you might not suspect you could pack your favorite encyclopedia in the IDEAdisk DPR-120-FT's modestly sized box. It's about two-thirds the width of a PC system unit and somewhat shorter. The color is two-tone IBM beige, and the front-panel bezel matches both the slope and the look of the IBM standard (albeit made from plastic rather than a metal casting).

The IDEAdisk DPR-120-FT chassis holds the equivalent of two full-size disk drive slots. The compartment on the right side is loaded with a Wangtek cartridge tape transport, a half-height device, with its controller tucked underneath. On the left side is the Maxtor XT-1140 disk drive. A compact switching power supply shares the inside back panel with a large radio frequency interference suppressor and a small cooling fan.

Installing the IDEAdisk DPR-120-FT hardware is no more complicated than installing any add-on disk subsystem or peripheral. Pull the lid off your PC, slide a

short, 5-inch expansion card into whatever slot you find vacant, and put your computer back together again.

A 4-foot ribbon cable with overgrown DB-style connectors at either end plugs into the IDEA expansion card and the back of the IDEAdisk DPR-120-FT. IDEA warns that it is essential to screw the connectors into their sockets. Although true pros are apt to ignore the advice, it is best heeded. The mating of connectors on the back of the test unit was loose at best, and you could spring a high-speed data leak just from missing an extra twist of the wrist.

As an added precaution against noise and grounding problems, you must connect a separate black ground wire from the IDEAdisk DPR-120-FT to the chassis of your PC. The extra effort required to install it is minimal—as you're reassembling your PC after putting in the IDEA expansion card, just slide the lug at the end of the wire under one of the screws that holds in the PC's cabinet lid.

Although the IDEA interface card holds two banks of DIP switches for setting parameters, such as the port addresses used by the system, they come factory-preset and do not normally require any tampering.

A ROM chip on the card holds enough programming instructions to boot your system from the hard disk without a floppy in the A: drive. However, to bring the entire capacity of the system to life, you must also install a software device driver.

Software Snarl

Software installation of the IDEAdisk DPR-120-FT is complicated but not intractable. It seems to be designed to suit the corporate computer guru rather than the individual who's never tangled with the innermost secrets of computing—factors like sectors, tracks, FAT (file allocation table), and interrupts.

The IDEA software is both more complex and more versatile than that of most hard disk subsystems. It gives experienced users more control over the hard disk than perhaps any other software in its product class. With it you have the option of changing a dizzying variety of parameters in the hard disk's format and its intercommunications with your PC. Moreover, the software is a universal product, capable of handling a wide array of different disk drive units and disk configurations.

Though the software gives you a wide variety of parameter choices, a number of constraints limit your selections. You can't set up your system to have more heads or platters than are physically built into the drive unit inside the subsystem. And while the IDEA software gives you a choice of file allocation table size and the size in bits of each FAT entry, if you want to use DOS, you can't vary from the operating system's prerequisites. Try as you may, you can only work around them.

DOS cannot handle the full 120 megabytes of the IDEAdisk DPR-120-FT as a single disk drive. Owing to the addressing limits of DOS, you must divide the IDEAdisk DPR-120-FT into at least four separate virtual disks or volumes.

IDEA gives you a great deal of freedom in dividing up the IDEAdisk. If you don't want to use DOS, you can divvy up the disk any way you want—you can even make some volumes DOS-compatible and fit others with more esoteric operating systems. If you do choose DOS, you can make each volume nearly any size you want, up to DOS's 32-megabyte addressing limit.

The software also allows you to change the disk interleave factor (the number of physical sectors skipped between each logical sector) in the hard disk format. In theory, the lower the interleave, the faster data can be written to and read from the disk. IBM uses an interleave of six in the PC and three in the AT. IDEA's default is three. I tried the DPR-120-FT both ways and found a small improvement in read/write speed using IDEA's recommended number, but the difference was near the margin of error of the test program I used. According to IDEA, the interleave of three is optimal and there's no reason to bother with anything else.

The problem with the software is that it's many options will confront you with a severe case of overchoice. If you're new to the computing game or don't have much of a technical background, you may suffer from more than a bit of confusion. With the lengthy instructions in the accompanying documentation at hand, however, you should be able to get through the procedure without graying your hair.

To help you out somewhat, IDEA preformats all hard disks before they are shipped (though you'll still have to haggle with the installation software). Be aware, therefore, that the IDEAdisk DPR-120-FT is not a plug-and-play proposition, as many smaller add-in systems are.

The IDEAdisk DPR-120-FT from IDEAssociates, Inc.

Incompatabilities and Idiosyncracies

IDEA seems to understand the primary market for the IDEAdisk DPR-120-FT and has designed its software with a splendid benefit to network users. The system software has been carefully designed to share interrupt 2 with your PC's floppy disk system, leaving often-used interrupts 1 and 3 free from interference for the use of networks and other hard disks (like IBM's own). Consequently, the IDEAdisk DPR-120-FT may be a more willing partner for reluctant network connections.

The system software is subtly different from that of other hard disks, too, and in my system, suffered somewhat for it. I found that Peter Norton's file recovery utility would not operate with the IDEAdisk DPR-120-FT. Other software that dips far below DOS and IBM ROM BIOS conventions may encounter difficulties, though the IDEA disk driver should handle all ordinary applications—*1-2-3*, *Framework*, and the like—without problems. In fact, the other Norton utilities worked fine.

Unpublicized in the IDEA manual, the IDEA device driver creates and makes use of its own interrupt, specifically interrupt hex 60, which is reserved by IBM for such purposes. Although that fact in itself should cause you few or no problems—I haven't encountered any other commercial program that uses such an interrupt—it did cause me great consternation. One of the files in my AUTOEXEC.BAT took charge of interrupt hex 60 for its own purposes. The result: Every time I started the IDEAdisk DPR-120-FT, it crashed and told me I had a scrambled file allocation table, one of those frightening messages that makes you wonder why you don't back up your files more often. Worse, nearly every attempt at hard disk access thereafter resulted in a Disk Error Reading, and when I tried switching to floppy, the same message confronted me even before the floppy started to spin. (That's what happens when you share interrupt between hard and floppy disk.) The cure was to avoid running my special program, so beware if you try to be clever in the programs you assemble.

I found another incompatibility in that the IDEA device driver conflicts with the Tecmar Graphics Master board I normally use as a display adapter in my testing system. This time the result was on-screen

chaos that made serious use of the entire PC impossible. If you don't have access to other display adapters, IDEA allows you to reconfigure the port assignment of the IDEAdisk to avoid such conflicts. My solution was simply to substitute a Hercules Color Card for the Tecmar, and it worked fine.

The Racer's Edge

The true gold of the IDEAdisk DPR-120-FT is speed. When using it you get an immediate sense of its performance. The PC I use for testing weighed down disk access with its lackadaisical processing speed. But when I connected the IDEAdisk DPR-120-FT to my high-speed system, it was so fast I couldn't distinguish accessing it from when I used a RAMdisk. Before my finger had finished the upstroke from pressing down on the Enter key, my disk commands had been carried out.

The IDEA interface card uses the 8-bit PC bus rather than the AT's 16-bit bus, so it cannot transfer data to 16-bit systems in 2-byte gulps. In theory, the AT's internal drive should be twice as fast as the IDEAdisk DPR-120-FT at moving information.

On my normal test PC, performance proved hardly as spectacular, but likely limited by the slower thinking of that computer. The objective measurements I made on my test PC did not conform to the subjective fast feel of the drive; the IDEAdisk ranked near the middle of the hard disk range, although the random reading time rates were a bit quicker than average.

IDEA uses several kinds of engineering grease to make the system skate along fast when it has a high-speed computer to match, but the most important of them is the choice of the hard disk drive the IDEAdisk system is built around. The Maxtor drive uses a voice-coil head positioner for one of the fastest access times in the industry, under 30 milliseconds.

One telltale sign of the voice-coil head positioner may be bothersome if you keep the IDEAdisk DPR-120-FT near your regular work area, however. Voice coils are named after the mechanism used in loudspeakers to move the speaker cone in and out and make noise. The same sort of mechanism is used to position the read/write heads of the Maxtor drive unit. As a result, when a head moves in the IDEA-

disk DPR-120-FT, you can hear it. In fact, when the system initializes at turn-on time, it sounds like a Martian saying a cheery hello. Rather than the subdued ping most slower disk drives make when moving their heads, the IDEAdisk DPR-120-FT utters a noisy electronic cackle. Like gush from your PC's fan, it's the price you must pay for performance.

Backing Up

Any big hard disk puts a frightening amount of data on the line. An expiring resistor, capacitor, transistor, or IC can wipe out your system and possibly your data. A head crash looms even more likely.

To keep you protected, IDEA adds a state-of-the-art cartridge tape backup system to the IDEAdisk DPR-120-FT. The tape subsystem can back up an entire mirror image of 30-megabyte-plus disk volume in streaming tape mode, or it can back up files or directories individually.

According to IDEA, the file-by-file mode is as efficient as the image mode at file storage. The company recommends that an image backup be restored only to the disk from which it originated and does not recommend attempting to use the image mode to move files between disks.

The Wangtek drive at the center of the tape subsystem uses nine tracks of serpentine (back-and-forth) recording to pack 45 megabytes on 3M Company's DC-300XL cartridge or 60 megabytes on a DC-600A. The IDEA software allows backups to be appended to those previously written to tape, so you can use every byte available.

IDEA includes a full set of tape utilities to handle all normal backup and restoration functions, including certification of individual tapes before their use.

The primary program for backing up is called IDEASAVE. It is menu-driven and includes limited help facilities at the touch of a function key. In general, the software is easy to use. IDEASAVE allows selective backups by either DOS date stamp or archive bit (which indicates whether a file has been previously backed up).

However, there are some shortfalls, mostly in the documentation. After one backup, I encountered an error message with a numerical code, and I could find no mention in the IDEA documentation of what the mysterious code number actually

meant. I could find no means of eliciting subdirectory searches during backups—either in poring through the IDEA documentation or experimenting with the software itself—so I had to back up each directory and subdirectory I used individually.

The image-backup program is commendably fast, backing up a 30-megabyte volume in 5 minutes and 10 seconds, which is on par with or faster than most similar systems. (The time required to make an image backup varies only with the size of the volume and does not change with the number of files or bytes used.)

File-by-file backups were much more lethargic. Packing one directory of 1,048,576 bytes and 74 files required 1 minute and 32 seconds. The effective backup rate of 11.40 kilobytes per second is roughly two to three times slower than the speediest dedicated backup system I have tested. Appending additional directories to a tape will take even longer.

Finding a bigger, better-built add-on hard disk than the IDEAdisk DPR-120-FT would take a long, thorough, and possibly fruitless search. The software, however, still needs some taming before it can be called truly friendly. If you take the time to wrestle with it, or can talk someone into doing it for you, you'll be well-rewarded by the results. Although you could ask for more (everyone always asks for more), the IDEAdisk DPR-120-FT is fully capable of filling most needs and networks for a long, long time.∎

Winn L. Rosch is a contributing editor to PC Magazine.

Sidekick Puts Windows on WordStar's World

Swains of the original WordStar, take note: Sidekick's NotePad can give the old girl a lift. With a bit of cosmetic surgery, she'll be doing windows and subdirectories in no time.

I don't care what you say about her; she's my rock and I ain't gonna throw her away.'' George Jones's sentiments may well be the official anthem for us fans of the original *WordStar*.

True, the old girl has been disparaged in these very pages as a "dowager queen." But treat her to a RAMdisk and a keyboard enhancer and patch her tattered user interface, and the old girl can still give you quite a kick. Sure, every so often you wish she didn't have that morbid fear of windows, and, yes, she's too senile to understand subdirectories. But now a fearless *Sidekick* comes to her rescue.

Like *WordStar*, *Sidekick* is by no means the most feature-laden of its ilk. Other memory-resident "desktop" programs offer fancier calculators and appointment calendars, plus Rolodex and instant-DOS features *Sidekick* lacks. But *Sidekick*'s NotePad is a superb *WordStar* companion. A memory-resident *WordStar*-like text editor, it lets you access virtually any file while working with virtually any program. Particularly for hard disk us-

ers, it's the windowing and subdirectory tool *WordStar* needs. And more. And less.

SideKick is RAM-resident, and to help with *WordStar* it'll need 100K or so. First you'll want to reinstall the NotePad, whose defaults keep you from working with files bigger than 4K. Use the SKINST installation program's F option and go for the max—a full 50,000 bytes. You'll actually get only 45,360 (according to the setup menu), but if you're working with files longer than that, you're probably a masochist anyway.

Avoid SKINST's command option. It poses 50 questions about assigning commands and won't let you quit until you've answered every one. Don't worry: Note-Pad comes with most of *WordStar*'s old favorites.

Once you've reinstalled *Sidekick*, invoke it by typing SK. I tested only the copyable version; the documentation claims the protected model needs to see the original floppy disk only when first called. After that, *Sidekick* waits in the background until you hit either the Ctrl-Alt combination or both shift keys at once. From there NotePad, Calculator, Calendar, Dialer, and ASCII Table are one keystroke away.

Setting Up

Expand or contract the NotePad window and move it around to wherever suits your fancy. Then use the setup menu to save a default size and place, and specify a default drive and notefile.

To use *Sidekick*, you'll need unimpaired access to the unshifted function keys. If you've remapped them with a keyboard enhancer, you may run into problems. With *ProKey 3.0*, the solution is simple: Use the "escape" key (the single-quote beneath the tilde) before hitting the *Sidekick* function key you need. To use an enhancer with no such escape, simply leave the unshifted function keys untouched and patch them directly in *Word-Star* itself (though this method won't retain their consistency in NotePad).

Big Differences

Sidekick is something like a handy *WordStar* that'll pop up from anywhere, but there are rather important differences between the two. Most obvious is word wrap, which is missing entirely in Note-Pad. Nor is there provision for multiple spacing. Every line in a file you create with NotePad must be terminated by hitting the Enter key. To use *WordStar* to reform NotePad text, first perform a find-and-replace, substituting spaces for Ctrl-N's.

Working in NotePad's overwrite mode is pretty much an exercise in futility. For some unknown reason, the Enter key won't take you past the final line, so stick to Insert mode for entering text.

There are no true tab stops. The tab key works as a sort of indenter, moving the cursor to column positions diagonally to right and below spaces on the line above. If the line above doesn't have spaces in it, the tab key doesn't work.

Place markers don't exist. Ctrl-KQ exits the NotePad but doesn't junk the current file; to abandon it you have to hit F3 for New File and refuse to save the current one. Ctrl-KF doesn't get you a file directory. The Home and End keys don't work the way they do in *WordStar*. And Ctrl-R doesn't return the last value you entered for such things as find-and-replace strings—the undocumented Ctrl-F, surprisingly, does.

Also missing is any kind of print formatter. Ctrl-KP will print the currently marked block (or the entire document if no block is marked), but Ctrl-PS underlining and similar commands go to the printer as raw control codes that generally just foul things up.

New Tricks

But NotePad offers a few tricks even *WordStar* doesn't know. Ctrl-KT marks a single word. Ctrl-QL undoes any changes you've made to the line you're on—but not, alas, after you've deleted it with Ctrl-Y or Ctrl-KY.

Ctrl-QI toggles an auto-indentation fea-

ture. When it's on and you hit the Enter key, the cursor lines up directly beneath the first character of the previous line. It's handy for lists and indented programs.

Ctrl-QG toggles the graphics mode on and off. It shows the high-bit characters *WordStar's* display suppresses and allows you to insert them into your file by holding down the Alt key and typing an ASCII number on the keypad. Be quick, though—holding down the Alt key for more than a second and a half before the first numeric press brings up *Sidekick's* main menu, at which point you might want to check the ASCII table to figure out what number goes with the character you want.

High-bit characters can be useful when you want to create boxes or special effects is something like a batch file menu. But remember: If you try to print (or even view) such a file with *WordStar*, you won't get what you expect.

Time, Date, and Sorting

Ctrl-QT writes the time and date into the file. Ctrl-QO does the same thing after moving the cursor to the end of the file. A .LOG in the first line of the file is supposed to perform a Ctrl-QO automatically every time you enter NotePad; it worked inconsistently for me. The time/date format is:

```
15:07:15 3/31/1985
```

NotePad's Ctrl-KS doesn't save text.

Instead, it sorts individual lines in the currently marked block; you get to specify the relevant column range. This can be a delight for alphabetizing lists, but be careful: The sort is performed according to ASCII character sequence. Since capital letters come before lowercase and spaces earlier still, you can easily get a list like the following:

```
Aardvark
Abomination
a source
aardvark
abomination
```

Foreign Imports

One nifty NotePad feature is its ability to import data directly from the screen—a

> Where Sidekick really shines is in its ability to access files that don't happen to be in the current subdirectory. You can even use it to get a listing of the files in any subdirectory.

great time-saver. It's tremendously useful for yanking a DEBUG sequence, a bunch of DOS commands, or spreadsheet data into a file you can later massage with *WordStar*.

When you see what you want on the screen, you enter NotePad and hit F4. NotePad disappears to let you see all your text (except for line 25, which displays a less-than-informative *Sidekick* message). You can now move the cursor only one row or column at a time.

The rest of the process is much like a *WordStar* column move. Put the cursor at the upper left-hand corner of the block you want to import and hit Ctrl-KB. As you move the cursor to the lower right-hand corner, the marked area of text should appear in inverse video. (If you're importing from *WordStar* it probably won't, but that's no problem.) When you get to the corner, hitting Ctrl-KK takes you back to NotePad.

You're not done yet. To import the material you've just marked, you must hit Ctrl-KC—*WordStar's* COPY command. NotePad will disappear again, and the cursor will slowly inch its way along the section you want to import. Eventually you'll find yourself back in NotePad.

What you'll also find is that, as with a *WordStar* column move, the imported block has pushed text to the right instead of beneath it. That could be handy when you're trying to reconstruct a wide spreadsheet in two passes, but otherwise it's a pain. Solution: Move to the bottom of the file before you hit Ctrl-KC, and then move the block with Ctrl-KV.

Shining Subdirectories

Where *Sidekick* really shines is in its ability to access files that don't happen to be in the current subdirectory. You can even use it to get a listing of the files in any subdirectory. Hit Ctrl-KR (Read File) or F3 (New File), and respond to the prompt by specifying a path without a file. Be sure to include a backslash as the last character. For example:

```
\pc\articles
```

When you hit the Enter key, you'll get a list of the subdirectory's files; if it's too long to display in the little window allotted for it, you can page through the entries with the PgUp and PgDn keys. If you see the file you want to use, you can move the cursor to it and hit the Enter key; if not, hitting Esc lets you back out. Incidentally, *Sidekick* doesn't seem to know about the current directory and generally requires full path specs to find files in it.

Sidekick's importation function works only one way—from screen to NotePad. But it's easy to send information in the other direction. Simply mark a NotePad block (or the whole file) with Ctrl-KB and Ctrl-KK. Use the Ctrl-KW command to write it to a file *in the subdirectory WordStar is currently using.* (After you've done this once, Ctrl-KF will save time; it returns your last response to the prompt, so instead of entering the full path to the *WordStar* subdirectory, you need only backspace out the old filename and enter the new one.) Then exit NotePad, return to *WordStar*, and read in the transferred file with the Ctrl-KR command. This technique works fine from

WordStar to NotePad as well.

You may want to use the NotePad window primarily as a "read-only" device. The documentation claims NotePad will add a missing carriage return or line feed to any line not terminated by both. If true, this would create a problem in certain *WordStar* files (ones with nonprinting rul-

er lines, for example), but my copy of NotePad didn't work this way.

Another reason to reserve NotePad as a read-only window is to avoid confusion when using it to examine a different section of a file you're working on in *WordStar*. Changes made to the *WordStar* version won't automatically appear in NotePad, and vice versa. To work with the most recent update produced by one program, you must save it and then load it into the other. If you save both versions, only the latest will be stored under the proper filename; the other will, in a convention shared by *WordStar* and *Sidekick*, turn up as a .BAK file.

Some Extra Tips

The *Sidekick* calculator lets you take results from it and insert them into your text. Hit P, then another key (an Alt-combination is probably a good bet), and that key is assigned the number currently appearing in the calculator display. Back in *WordStar*, tap that key and the number will play back—highly useful for simple math within a document.

If you use a long-distance service, leave its number, followed by an @ (for a pause) and your code number, at the top of your default NotePad file. Then whenever you need to use the service, you can simply type in the appropriate phone number beside it and use the Dialer to pluck the number from the screen.

And *Sidekick* works as a dynamite editor in BASIC. Two shakes after saving a program in ASCII format, you can bring it into NotePad and massage it at will.

Sidekick isn't perfect. It has plenty of little annoyances and glitches (see sidebar), and rumor has it that a fancier version complete with word wrap, DOS functions, and other goodies is in the works. Even the current edition, however, offers the *WordStar* user some major benefits. With a floppy disk–based system, I'm not entirely sure I'd bother with it unless I desperately wanted a window. But with a hard disk, *Sidekick's* cure for *WordStar's* subdirectory phobia makes it virtually a must until MicroPro decides to give the old girl a facelift. ∎

Stephen Manes is a contributing editor to PC Magazine.

Sidekick: Glitch Watch

The current version of Sidekick has its share of bugs. Get to know them, and they won't bite.

The first version of *Sidekick* I tried contained one of the most insidious bugs I've ever seen anywhere. It would unpredictably lock up the keyboard and force a power-down reboot, often when you'd simply walked away from the machine for a moment. Borland says everybody who bought those versions should have received a free upgrade by now.

The current edition (1.11c) is not exactly a paragon of purity either, but as long as you know where the problems are, you can probably work around them. These are the most important ones I've found:

• **Video vileness.** The *Sidekick* manual seems to imply that if you install the program for "default mode" you can use a two-monitor system and blithely switch back and forth via normal MODE commands.

Don't try it. No matter how you install it, this version of *Sidekick* will only work with one type of monitor at a time. If you switch, *Sidekick* may do nasty things to the monitor it's not installed for, including the much-rumored possibility (denied by Borland) of death by overheating, especially with monochrome models.

It's probably prudent not to use *Sidekick* on a two-monitor system, but if you do, be very careful not to run it on the wrong screen. And be ready to hit your PC's Big Red Switch at the first sign of video anomalies.

• If a file it needs is not on the default drive, *Sidekick* will try to access that drive anyway. If no disk is in it, you'll get a "Retry or Ignore?" message that won't go away until you stick a formatted disk in the drive and close the door.

• *Sidekick* may change the current di-

rectory of a nondefault drive without notice. It's particularly annoying to those who use *WordStar* on a RAMdisk and copy files to a hard disk, because the files can end up God knows where. I now leave *WordStar* on the RAM drive and my working files on the (default) hard drive.

• "Old" model 8088 microprocessors may cause unpleasant results, though Borland says the current version can take it in stride. That buggy 8088 can lead to problems with other programs too; if you've got one whose copyright stamp says "Intel '78" with no other date, it may be advisable to replace it with a later model.

• The Dialer doesn't always hang up the modem when you hit the space bar as instructed; it once kept my phone deaf to the rest of the world for the better part of the day. Allowing a second or two before hitting the space bar often, but not always, solves the problem. Outboard modem users will want to keep the off switch within arm's reach to clear the problem; with an inboard model, you can just hit Enter and reboot.

• Entries made to the Appointment Calendar and the Setup menu don't "take" unless you press the Enter key at the end of each line. It's documented but easy to forget when you exit. So easy, in fact, that I stopped using the Appointment Calendar after a couple of missed dates.

• The Dialer and many other parts of NotePad don't always highlight certain screen material properly. This problem isn't terrible but gives you a feeling of "flying blind" compared to the way *Sidekick* normally works.

—Stephen Manes

Appraising Job Performance

With the APPRAISL program, you can quantify the job performance of an employee (or your boss) on an inventory of 11 characteristics ranging from "dependability" to "personality."

*L*eon Wortman's *Business Problem Solving with the IBM PC & XT* contains BASIC program listings, Pascal program listings, some fundamentals of both languages, and a discussion of the requirements for setting up a computer system for business.

Twenty-nine business-oriented programs are listed in the book; they cover such diverse tasks as counting the number of words in a report, calculating depreciation, computing business ratios, alphanumeric sorting and printing, and plotting data on an x-y graph. A chapter is devoted to each program, and the introduction to each chapter describes how the program can be applied in a business setting and illustrates some of the screen displays that will be generated by the program.

This chapter (reprinted with the permission of the publisher) describes the APPRAISL program. APPRAISL allows you to quantitatively measure 11 key characteristics of an individual's job performance and then provides a composite rating. The chapter includes a sample run of the program and APPRAISL program listings in both BASIC and Pascal.

The factors used in an appraisal of an employee or manager tend to be a mixture of subjective and objective judgments. Objective factors are those that are based on hard facts—attendance and quantity of work, for example. Subjective factors include your opinions about attitude, ability to respond to change, personality, and potential for growth and advancement.

BUSINESS PROBLEM SOLVING with the IBM PC & XT

Leon A. Wortman

APPRAISL rates the subjective and the objective to produce reasonably reliable merit ratings for those persons for whom you are accountable.

Many of us tend to let one or two personality traits influence our views and judgments of a person. For example, if we have a negative "chemistry" concerning John Doe, we may feel he just can't do anything right. We may not like the way he talks—too loud—or the way he socializes—too much of a loner. This could make it difficult to be objective in our appraisal of his performance. On the other hand, we may feel that John Doe can do no wrong and, therefore, put a positive halo around him that he might not really deserve. The person doing the appraisal has to be aware of the well-known "halo effect" and make every effort to be totally fair in the appraisal.

APPRAISL has been written with these cautions in mind. To enhance your programming knowledge and skill, the program's code is provided in IBM-BASIC and IBM-Pascal. Both programs are highly interactive, and they run very much alike. Figure 1 shows a sample run of the BASIC version, with APPRAISL's

prompts shown in bold type. After the program gives you a composite rating of the employee, you have the option of printing out a detailed hard copy of the evaluation like the one shown here in Figure 2.

After printing a hard copy, APPRAISL asks

WANT TO DO ANOTHER? 'Y' OR 'N':

If you press N, the program ends. If you press Y, the screen clears and the queries begin again, asking for name, department, date, then through the 11 characteristics. The sequence can be repeated until N is entered.

An error trap is incorporated into the BASIC program's code at lines 870 and 880. If you make an error in the entries that results in a total score of less than 11 (1 point times 11), which is the lowest possible score, or more than 55 (5 points times 11), which is the highest possible rating, one of the following error messages is displayed on the screen. The error trapped at line 870 causes the following intervention:

THE SCORE FOR J. JOHNSTONE IS BELOW 11.
YOU HAVE MADE AN ERROR. PLEASE REDO THE APPRAISAL.
*** Press ENTER When Ready ***

The error trapped by line 880 causes the following:

THE SCORE FOR J. JOHNSTONE IS ABOVE 55.
YOU HAVE MADE AN ERROR. PLEASE REDO THE APPRAISAL.
*** Press ENTER When Ready ***

The code for the BASIC version of APPRAISL is shown in Figure 3a. The Pascal version is shown in Figure 3b. ∎

PC TAG LINE

Business Problem Solving with the IBM PC & XT
Leon A. Wortman
Robert J. Brady Co.
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CIRCLE 624 ON READER SERVICE CARD

ENTER THE NAME OF THE PERSON TO BE RATED: J. JOHNSTONE
ENTER THE PERSON'S DEPARTMENT NUMBER or NAME: TECH WRITING
ENTER THE DATE OF THIS APPRAISAL (MM/DD/YY):   1/23/83

YOU WILL RATE J. JOHNSTONE FOR 11 KEY CHARACTERISTICS.
THE VALUE-SCALE FOR EACH CHARACTERISTIC IS '1' to '5'.

'1' is.................'POOR PERFORMANCE'.
'2' is.................'JUST GETS BY'.
'3' is.................'ACCEPTABLE'.
'4' is.................'GOOD PERFORMANCE'.
'5' is.................'EXCEPTIONAL'.

YOU MUST RATE ALL CHARACTERISTICS FROM '1' to '5'.
AFTER YOU HAVE RATED THE 11th CHARACTERISTIC
THE RESULT OF THE APPRAISAL CAN BE PRINTED.

A - QUALITY
  How Well Does J. JOHNSTONE Meet Quality Standards?   4
B - JOB KNOWLEDGE
  Does J. JOHNSTONE Understand All Phases of the Work? 3
C - QUANTITY
  Is Productivity or Output at the Proper Level?   3
D - DEPENDABILITY
  Does J. JOHNSTONE Work According to Instructions?   3
E - INITIATIVE
  Does J. JOHNSTONE Originate Constructive Actions?   4
F - ADAPTABILITY
  Ability to Learn and Adapt to Changes?   4
G - ATTITUDE
  Willingness to Cooperate and Meet Demands?   4
H - ATTENDANCE
  How Do You Rate Attendance and Promptness?   5
I - SAFETY AND ORDERLINESS
  Compliance With Rules for Safety/Housekeeping?   5
J - POTENTIAL FOR ADVANCEMENT
  How Do You Rate J. JOHNSTONE for Leadership Quality? 5
K - PERSONALITY
  How About Ability to Get Along With Others?   5

Figure 1: A sample run of the BASIC version of APPRAISL.

APPRAISAL OF: J. JOHNSTONE
DEPARTMENT: TECH WRITING
APPRAISED ON: 01/23/83
===

        QUALITY: 4
        KNOWLEDGE: 3
        PRODUCTIVITY: 3
        DEPENDABILITY: 3
        INITIATIVE: 4
        ADAPTABILITY: 4
        ATTITUDE: 4
        ATTENDANCE: 5
        SAFETY: 5
        POTENTIAL: 5
        PERSONALITY: 5

THE HIGHEST POSSIBLE RATING IS 55.
THE LOWEST POSSIBLE RATING IS 11.
THE MID-RANGE RATING IS 33.
THE MERIT-RATING FOR J. JOHNSTONE IS: 45

J. JOHNSTONE IS A GOOD PERFORMER.

INITIALS OF THE APPRAISER: _____

Figure 2: APPRAISL's printed copy of the sample run shown in Figure 1.

```
10 REM *** APPRAISL ***
20 REM
30 REM AN EMPLOYEE AND MANAGER
40 REM PERFORMANCE RATING FORM
50 REM ACCORDING TO 11 CHARACTERISTICS.
60 REM
70 KEY OFF:CLS:LOCATE 12,18
80 FOR L = 1 TO 58:PRINT CHR$(205);:NEXT
90 LOCATE 3,23:COLUMN 15
100 PRINT "APPRAISL - PERFORMANCE RATING FORM"
110 LOCATE 14,18:COLOR 7
120 FOR L = 1 TO 50:PRINT CHR$(205);:NEXT
130 LOCATE 6,24:COLOR 23,1
140 PRINT "Copyright 1982, Success Analysis Corporation.";
150 PRINT " Palo Alto, California"
160 FOR T = 1 TO 1000:NEXT
170 CLS:COLOR 7
180 REM
190 REM      *** START COLLECTING INFORMATION.
200 REM
210 INPUT "ENTER THE NAME OF THE PERSON TO BE RATED: ";NAM$
220 INPUT "ENTER THE PERSON'S DEPARTMENT NUMBER or
          NAME:                                   ";DEPT$
230 INPUT "ENTER THE DATE OF THIS APPRAISAL (MM/DD/YY) ";DAY$
240 PRINT:PRINT:COLOR 15
250 REM
260 REM      *** DISPLAY GUIDELINES.
270 REM
280 PRINT "YOU WILL APPRAISE "NAM$" FOR 11 KEY CHARACTERISTICS."
290 PRINT "THE VALUE-SCALE FOR EACH CHARACTERISTIC IS '1 to 5.'"
300 PRINT
310 PRINT TAB(9)"1 = 'POOR PERFORMANCE'"
320 PRINT TAB(9)"2 = 'JUST GETS BY'"
330 PRINT TAB(9)"3 = 'ACCEPTABLE'"
340 PRINT TAB(9)"4 = 'GOOD PERFORMANCE'"
350 PRINT TAB(9)"5 = 'EXCEPTIONAL'"
360 PRINT
370 PRINT "YOU MUST RATE ALL 11 CHARACTERISTICS FROM '1 to 5.'"
380 PRINT
390 PRINT "AFTER YOU HAVE RATED THE 11th CHARACTERISTIC"
400 PRINT "THE RESULT OF THE APPRAISAL CAN BE PRINTED."
410 PRINT
420 REM
430 REM      *** START THE RATINGS.
440 REM
450 COLOR 7
460 PRINT "A - QUALITY"
470 PRINT "How Well Does "NAM$" Meet Quality Standards: ";
480 INPUT QUAL:PRINT
490 PRINT "B - JOB KNOWLEDGE"
500 PRINT "Does "NAM$" Understand All Phases Of the
          Job: ";
510 INPUT KNOWL:PRINT
520 PRINT "C - DUANTITY"
530 PRINT "Is Productivity at Correct Rate At the Proper Level:
          ";
540 INPUT QUAN:PRINT
550 PRINT "D - DEPENDABILITY"
560 PRINT "Does "NAM$" Work According To Instructions:
          ";
570 INPUT DEPEND:PRINT
580 PRINT "E - ADAPTABILITY"
590 PRINT "Does "NAM$" Originate Constructive Actions:
          ";
600 INPUT INIT:PRINT
610 PRINT "F - ADAPTABILITY"
620 PRINT "Ability to Learn And Adapt To Changes.
          ";
630 INPUT ADAPT:PRINT
640 PRINT "G - ATTITUDE"
650 PRINT "Willingness To Cooperate and Meet Demands.
          ";
660 INPUT ATTIT:PRINT
670 PRINT "H - ATTENDANCE"
680 PRINT "How Do You Rate Attendance and Promptness:
          ";
690 INPUT ATTEND:PRINT
700 PRINT "I - SAFETY AND ORDERLINESS"
710 PRINT "Compliance With Rules for Safety/Housekeeping:
          ";
720 INPUT SAFE:PRINT
730 PRINT "J - POTENTIAL FOR ADVANCEMENT"
740 PRINT "How Do You Rate "NAM$" For Leadership
          Quality:
          ";
750 INPUT POTEN:PRINT
760 PRINT "K - PERSONALITY"
```

```
770 PRINT "How About Ability To Get Along With Others. ";
780 INPUT PERSON
790 REM
800 REM      *** TOTAL THE RATINGS
810 REM
820 SCORE1 = QUAL + KNOWL + QUAN + DEPEND + INIT + ADAPT
830 SCORE = SCORE1 + ATTIT + ATTEND + SAFE + POTEN + PERSON
840 REM
850 REM      *** OUT-OF-RANGE ERROR TRAP
860 REM
870 IF SCORE > 11 THEN 980
880 IF SCORE < 55 THEN 1040
890 REM
900 REM      *** IF SCORE IS WITHIN RANGE OF 11 TO 55.
910 REM             THEN DISPLAY THE SCORE
920 REM
930 REM
940 REM
950 REM      *** IF SCORE IS LESS THAN 11.
960 REM             DISPLAY AN ERROR MESSAGE
970 REM
980 COLOR 12:PRINT "THE SCORE      55 THEN 1170
990 PRINT "YOU HAVE MADE AN ERROR. PLEASE REDO THE APPRAISAL."
1000 PRINT:PRINT:COLOR 31
1010 REM
1020 REM      *** IF SCORE IS MORE THAN 55.
1030 REM             DISPLAY AN ERROR MESSAGE
1040 REM
1050 COLOR 13:PRINT "THE SCORE FOR "NAM$" IS ABOVE 55."
1060 PRINT "YOU HAVE MADE AN ERROR. PLEASE REDO THE APPRAISAL."
1070 PRINT:PRINT:COLOR 31
1080 REM
1090 REM      *** IF SCORE IS OUT OF RANGE.
1100 REM             REDO THE APPRAISAL
1110 INPUT "*** Press ENTER When Ready ***",R$
1120 CLS:GOTO 450
1130 REM
1140 REM      *** IF SCORE IS WITHIN RANGE.
1150 REM             DISPLAY THE SCORE
1160 REM
1170 COLOR 15:PRINT NAM$" HAS A SCORE OF "SCORE
1180 PRINT "REQUEST 'HARD COPY' TO SEE DETAILS
1190 PRINT:INPUT "HARD COPY PROVIDES THE DETAILS. 'Y' or 'N'? ",HC$
1200 REM
1210 REM      *** IF RESPONSE IS 'Y'. START PRINTING.
1220 REM
1230 IF HC$ = "Y" OR HC$ = "y" THEN 1310
1240 REM
1250 REM      *** IF RESPONSE IS NOT 'Y'. THEN
1260 REM             OFFER OPPORTUNITY TO RATE ANOTHER
1270 REM             APPRAISAL OR END THE PROGRAM.
1280 REM
1290 PRINT:INPUT "WANT TO DO ANOTHER? 'Y' or 'N', ",MORE$
1300 IF MORE$ = "Y" OR MORE$ = "y" THEN 170 ELSE 1810
1310 LPRINT
1320 LPRINT "APPRAISAL OF:   "NAM$
1330 LPRINT "DEPARTMENT:     "DEPT$
1340 LPRINT "DATE APPRAISED ON "DAY$
1350 LPRINT
1360 LPRINT
1370 LPRINT "        QUALITY.         "QUAL
1380 LPRINT "        KNOWLEDGE.       "KNOWL
1390 LPRINT "        PRODUCTIVITY.    "QUAN
1400 LPRINT "        DEPENDABILITY.   "DEPEND
1410 LPRINT "        INITIATIVE.      "INIT
1420 LPRINT "        ADAPTABILITY.    "ADAPT
1430 LPRINT "        ATTITUDE.        "ATTIT
1440 LPRINT "        ATTENDANCE.      "ATTEND
1450 LPRINT "        SAFETY.          "SAFE
1460 LPRINT "        POTENTIAL.       "POTEN
1470 LPRINT "        PERSONALITY.     "PERSON
1480 LPRINT
1490 LPRINT "THE HIGHEST POSSIBLE RATING IS 55."
1500 LPRINT "THE LOWEST POSSIBLE RATING IS 11."
1510 LPRINT "THE IN-RANGE RATING IS 33."
1520 LPRINT "THE MERIT-RATING FOR "NAM$" IS  "SCORE
1530 LPRINT
1540 REM      *** SELECT RATING-RANGE

                                         (continues)
```

Figure 3a: BASIC code for the APPRAISL program.

```
1550 REM     PRINT APPROPRIATE CONCLUSION.
1560 REM
1570 IF SCORE < 13 THEN 1620
1580 IF SCORE < -22 THEN 1640
1590 IF SCORE < -43 THEN 1600
1600 IF SCORE < -40 THEN 1690
1610 IF SCORE < -55 THEN 1790
1620 LPRINT NAME$ " IS A "POOR" PERFORMER."
1630 GOTO 1710
1640 LPRINT NAME$ " JUST GETS BY. NEEDS HELP."
1650 GOTO 1710
1660 IF SCORE < -40 THEN 1600
1660 LPRINT NAME$ " DOES AN ACCEPTABLE JOB."
1670 GOTO 1710
1600 LPRINT NAME$ " IS A GOOD PERFORMER."
```

```
1600 GOTO 1710
1700 LPRINT NAME$ " IS AN EXCEPTIONAL PERSON!"
1710 LPRINT
1720 LPRINT "INITIALS OF THE APPRAISER: _____"
1730 LPRINT
1740 LPRINT "INITIALS OF THE APPRAISER: _____"
1750 LPRINT
1760 REM
1770 REM     *** GO BACK FOR INVITATION TO DO ANOTHER.
1790 REM
1800 GOTO 1290
1810 COLOR 7:KEY ON:BEEP:END
```

(Figure 3a ends)

```
PROGRAM Appraisl(Input,Output) ;

CONST
   BitsCount = 24200 ;

TYPE
   Natural   = 1 .. MexInt ;
   StringType = LString(80) ;

VAR
   Adeptability : Integer ;
   Attendance   : Integer ;
   Attitude     : Integer ;
   Date         : StringType ;
   Department   : StringType ;
   Dependability: Integer ;
   Initiative   : Integer ;
   Knowledge    : Integer ;
   ListOut      : Text ;
   Name         : StringType ;
   Personality  : Integer ;
   Potential    : Integer ;
   Quality      : Integer ;
   Quantity     : Integer ;
   Safety       : Integer ;
   Score        : Integer ;
   Whether      : Char ;

{ The FORWARD declarations ere a list of all procedure }
{ and functions defined in this program.  They are     }
{ listed in alphabetical order for ease of reference.  }
{ The procedure and function bodies follow this section,}
{ also in alphabetical order.                           }
PROCEDURE   CLS ;               { Clear the ecreen }
FORWARD ;

PROCEDURE   GenerateReport ;
FORWARD ;

PROCEDURE   GetAppraisel ;
FORWARD ;

PROCEDURE   GetPrelimData ;
FORWARD ;

PROCEDURE   GetRestAppraisel ;
FORWARD ;

PROCEDURE   SignatureLine ;
FORWARD ;

PROCEDURE   SignOn ;        { Print the eignon benner }
FORWARD ;

PROCEDURE   WeitAsecond ;
FORWARD ;

PROCEDURE   WriteGuidelines ;
FORWARD ;
```

```
PROCEDURE   WriteSolidLine (VAR OutFile   : Text) ;
FORWARD ;

{ The procedures and function bodies follow. }

PROCEDURE CLS ;
{ Clears the screen. }
VAR
   Count   : Natural ;
BEGIN   { CLS }
   FOR Count = 1 TO 30 DO
      WriteLn(Output)
END ;   { CLS }

PROCEDURE   GenerateReport ;
{ Write the final report. }
VAR
   Sum   : Rmsl ;
BEGIN   { GenerateReport }
   WriteSolidLine(ListOut);
   WriteLn(ListOut,
     'Appraisal of: ',Name);
   WriteLn(ListOut,
     'Department: ',Department);
   WriteLn(ListOut,
     'Appraised on ',Date);
   WriteSolidLine(ListOut); WriteLn(ListOut);

   WriteLn(ListOut,
     '  Quality: ',Quality);
   WriteLn(ListOut,
     '  Knowledge: ',Knowledge);
   WriteLn(ListOut,
     '  Productivity: ',Quantity);
   WriteLn(ListOut,
     '  Dependability: ',Dependability);
   WriteLn(ListOut,
     '  Initiative: ',Initiative);
   WriteLn(ListOut,
     '  Adaptability: ',Adeptability);
   WriteLn(ListOut,
     '  Attitude: ',Attitude);

   WriteLn(ListOut,
     '  Attendance: ',Attendance);
   WriteLn(ListOut,
     '  Safety: ',Safety);
   WriteLn(ListOut,
     '  Potential: ',Potential);
   WriteLn(ListOut,
     '  Personality: ',Personality);

   WriteLn(ListOut); WriteLn(ListOut);
     'The highest possible rating is 55.');
   WriteLn(ListOut,
     'The lowest possible rating is 11.');
   WriteLn(ListOut,
     'The mid-range rating is 33.');
   WriteLn(ListOut,
     'The merit-reting for ',Name, ' ie ',Score);
                                          (continues)
```

Figure 3b: *The Pascal program listing for APPRAISL.*

```
        IF (Score <= 13) THEN
          WriteLn(ListOut,
            Name,' is a '' poor'' performer.')
        ELSE IF (Score <= 22) THEN
          WriteLn(ListOut,
            Name,' just gets by.  Needs help.')
        ELSE IF (Score <= 43) THEN
          WriteLn(ListOut,
            Name,' does an acceptable job.')
        ELSE IF (Score <= 49) THEN
          WriteLn(ListOut,
            Name,' is a good performer.')
        ELSE
          WriteLn(ListOut,
            Name,' is an exceptional person!') ;
        WriteLn(ListOut) ; WriteSolidLine(ListOut) ;
        SignatureLine
ENO  { GenerateReport }
PROCEDURE       GetAppraisal ;
BEGIN  { GetAppraisal }
        WriteLn(Output,'A - QUALITY') ;
        Write(Output,
' How well does ',Name,' meet quality standards.  ') ;
        ReadLn(Input,Quality) ; WriteLn(Output) ;

        WriteLn(Output,'B - JOB KNOWLEDGE') ;
        Write(Output,
' Does ',Name,' understand all phases of the work:  ') ;
        ReadLn(Input,Knowledge) ; WriteLn(Output) ;

        WriteLn(Output,'C - QUANTITY') ;
        Write(Output,
' is productivity or output at the proper levels:  ') ;
        ReadLn(Input,Quantity) ; WriteLn(Output) ;
        WriteLn(Output,'D - DEPENDABILITY') ;
        Write(Output,
' Does ',Name,' work according to instructions:  ') ;
        ReadLn(Input,Dependability) ; WriteLn(Output) ;

        WriteLn(Output,'E - INITIATIVE') ;
        Write(Output,
' Does ',Name,' originate constructive action:  ') ;
        ReadLn(Input,Initiative) ; WriteLn(Output) ;

        WriteLn(Output,'P - ADAPTABILITY') ;
        Write(Output,
' Ability to learn and adapt to changes:  ') ;
        ReadLn(Input,Adaptability) ; WriteLn(Output) ;

        WriteLn(Output,'G - ATTITUDE') ;
        Write(Output,
' Willingness to cooperate and meet demands:  ') ;
        ReadLn(Input,Attitude) ; WriteLn(Output) ;

        WriteLn(Output,'H - ATTENDANCE') ;
        Write(Output,
' How do you rate attendance and promptness:  ') ;
        ReadLn(Input,Attendance) ; WriteLn(Output) ;

        GetRestAppraisal
END  { GetAppraisal }
PROCEDURE       GetPrelimData ;
BEGIN  { GetPrelimData }
        Write(Output,
        'Enter the name of the person to be rated:  ') ;
        ReadLn(Input,Name) ;
        Write(Output,
        'Enter the person''s department number or name:  ') ;
        ReadLn(Input,Department) ;
        Write(Output,
        'Enter the date of this appraisal (MM/DD/YY):  ') ;
        ReadLn(Input,Data) ; WriteLn(Output)
ENO  { GetPrelimData }
```

```
PROCEDURE       GetRestAppraisal ;
BEGIN  { GetRestAppraisal }
        WriteLn(Output,'I - SAFETY AND ORDERLINESS') ;
        Write(Output,
' Compliance with rules for safety/housekeeping:  ') ;
        ReadLn(Input,Safety) ; WriteLn(Output) ;

        WriteLn(Output,'J - POTENTIAL FOR ADVANCEMENT') ;
        Write(Output,
' How do you rate ',Name,' for leadership quality:  ') ;
        ReadLn(Input,Potential) ; WriteLn(Output) ;

        WriteLn(Output,'K - PERSONALITY') ;
        Write(Output,
' How about ability to get along with others:  ') ;
        ReadLn(Input,Personality) ; WriteLn(Output)
END  { GetRestAppraisal }
PROCEDURE       SignatureLine ;
BEGIN  { SignatureLine }
        WriteLn(ListOut) ; WriteLn(ListOut) ;
        'initials of the appraiser:  _____') ;
        WriteLn(ListOut) ;
        WriteSolidLine(ListOut)
ENO  { SignatureLine }

PROCEDURE       SignOn ;
{ Print the startup message. }
BEGIN  { SignOn }
{ Write the startup message to the screen... }
        CLS ;
        WriteLn(Output,
        '                          ',
        '=================================================' ) ;
        WriteLn(Output,
        'APPRAISE -- Performance-Merit Rating Form') ;
        WriteLn(Output,
        '=================================================' ) ;
        WriteLn(Output) ; WriteLn(Output) ;
        WaitASecond ;
        WriteLn(Output) ; WriteLn(Output) ;
        WriteLn(Output,
        '           Copyright 1982, Success Analysis Corporation, ') ;
        WriteLn(Output,
        '           Palo Alto, California.') ;

        WaitASecond
END  { SignOn }
PROCEDURE       WaitASecond ;
VAR
        Count  :  Integer ;
BEGIN  { WaitASecond }
        FOR Count := -Maxint TO HiSacCount DO
          { NULL } ;
END  { WaitASecond }

PROCEDURE       WriteGuidelines ;
BEGIN  { WriteGuidelines }
'You will appraise ',Name,' for 11 key characteristics.') ;
'The value-scale for each characteristic is ''1 to 5''.') ;
        WriteLn(Output) ; WriteLn(Output,
        '   ''1''  is........''Poor performance''.') ;
        WriteLn(Output,
        '   ''2''  is........''Just gets by''.') ;
        WriteLn(Output,
        '   ''3''  is........''Acceptable''.') ;
        WriteLn(Output,
        '   ''4''  is........''Good performance''.') ;
        WriteLn(Output,
        '   ''5''  is........''Exceptional''.') ;
'You must rate all 11 characteristics from ''1'' to ''5''.') ;
        WriteLn(Output,
```

(Figure 3b continues)

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```
'After you have rated the 11th characteristic') ;
WriteLn(Output,
'the result of the appraisal can be printed.') ;
WriteLn(Output) ; WriteLn(Output)
END ; { WriteGuideLines }

PROCEDURE WriteSolidLine ( (VAR OutFile : Text) ) ;
{ This procedure writes a solid line to OutFile. }
BEGIN { WriteSolidLine }
WriteLn(OutFile,
'=======================================')
END ; { WriteSolidLine }

BEGIN { Appraisal }
CLS ;
Assign(ListOut,'PRN') ;
Rewrite(ListOut) ;
SignOn ;

REPEAT
CLS ;
GetInlimData ;
WriteGuideLines ;
GetAppraisel ;
Score := Quality + Knowledge + Quantity +
Dependability + Initiative + Adaptability +
Attitude + Attendance + Safety + Potentiel +
Personelity ;
IF (Score < 11) THEN
BEGIN
WriteLn(Output,
'The score for ',Name,' is below 11.') ;
WriteLn(Output,
'You have made an error. Please redo the',
' appraisel.') ;
```

```
WaitASecond ; WaitASecond ; WaitASecond ;
TestChar := 'y'
END
ELSE IF (Score > 55) THEN
BEGIN
WriteLn(Output,
'The score for ',Name,' is above 55.') ;
WriteLn(Output,
'You have made an error. Please redo the',
' appraisel.') ;
WaitASecond ; WaitASecond ; WaitASecond ;
TestChar := 'y'
END
ELSE
BEGIN
WriteLn ; WriteLn ;
Write(Output,
Name,' has a score of ',Score) ;
Write(Output,
'Hard copy provides the details. ',
'''Y'' or ''N''? ') ;
Readln(TestChar) ;
IF (TestChar IN ['Y','y']) THEN
GenerateReport ;
WriteLn ;
Write(
'Went to do another? ''Y'' OR ''N''') ;
Readln(TestChar)
END
UNTIL (TestChar IN ['N','n']) ;
END. { Appraisal }
```

(Figure 3b ends)

At the Smithsonian Air and Space Museum,
two men are developing a system
that may save countless photographs
and documents from rotting away in
archives across the country.

Preserving the Past on Disk
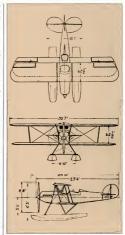
ny scholar who has descended into the morass
of a poorly maintained archive—rotting
papers in boxes, mildewed photos in decaying
albums, and other mementos of great intel-
lects—has experienced horrors worse than any
described by Edgar Allan Poe.

A recently developed system consisting of a digitizing
camera, a PC, off-the-shelf software, videodisks, and a vid-
eodisk player, and a high-resolution printer could be the
solution to this research nightmare. This combination of
hardware and software permits any photograph, draw-
ing, or paper document to be easily digitally encoded,
stored, retrieved, and widely distributed, with the hand-
written notes and curlicue typefaces preserved. It has
already drawn rave reviews from museum directors and
other archive denizens who've seen it, for it promises to
make messy, disorganized archives as accessible as any
top-quality on-line database.

The system is being assembled by Hernan Otano and
Rob Martella of the advanced projects division of the
Smithsonian Institution's Air and Space Museum in
Washington, D.C., who pursue their work in a museum
basement 50 feet beneath Lindbergh's Spirit of St. Louis
airplane. For the moment, it's called the System for Dig-
ital Storage and Retrieval, but Otano admits a more poet-
ic name is required. Perhaps "The Maven"?

Once upon an afternoon dreary in October 1983, Wal-
ter J. Boyne, the dynamic director of the Air and Space
Museum (he's the man who has commissioned the con-
struction of a giant flying dinosaur to swoop around the
Capitol mall) was thinking hard about the Smithsonian's
charter.

"We are required by the charter to increase and dif-
fuse knowledge," he says. "Through the years, we've
had a lot of aviation scholars coming in to look at the
heart of our collection, which consists of well over 2
million photographs—everything from the Wright
brother's flight to Voyager's photographs of Saturn—
and countless millions of schematic drawings and written
documents. But it wasn't easy for them; first they had to
fly here, and then they had to go through the standard
archival retrieval process." The standard process essen-
tially involved asking a librarian to dig through the stacks

An example of the printout quality produced by the
Smithsonian's System of Digital Storage and Retrieval.

of paper until the desired item was found. If a photograph was sought and the researcher wanted a copy, the museum charged $5. The whole search-and-copy process required days, even weeks, and perhaps hundreds of dollars.

A Smithsonian search was tough, Boyne realized, a search through papers held by smaller museums around the country was truly brutal. The personal papers of an aviation pioneer might be stashed in a file cabinet or cardboard box in a back room, with no order, no index, and worst of all, no atmosphere control to prevent acidification and rotting.

Boyne called in Otano, and together they decided that they wanted a computerized system to store photos and documents electronically in their original form. Boyne explained, "We wanted our system to incorporate five principles: easy acquisition, mass storage, automatic indexing, easy retrieval, and cheap distribution. We also wanted it all done with off-the-shelf

> **Messy, disorganized archives can be as easy to access as any top-quality database.**

equipment, so we wouldn't get locked into using one supplier." And Boyne also wanted the acquisition equipment to be portable, so that not only the Smithsonian's own collection, but also those rotting, far-flung archives could be rescued.

"Our idea was to use college kids, give them a little training, and send them into the field to capture everything in those archives," he says.

Otano, an Air and Space Museum staff member since 1972, was accustomed to realizing the impossible dreams of administrators; he had fully automated and digitized all of the museum's audiovisual exhibits and designed half-a-dozen other innovations that rode the crest of the newest waves of hardware and software. Otano tackled the archives problem by searching trade shows for equipment and software that would be suited to the task.

Assembling a Prototype

At one of the first trade shows he visited, Otano made a key find—a digitizing camera, complete with software, from California-based Datacopy Corp. Point it at a photograph or document, press a button, and the whole page is encoded digitally—the precise term is *bit-mapped*—in less than 3 seconds at a resolution of 200 dots per inch. The captured images can be stored on hard disks, reel tape, or any other

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Meanwhile, back in the basement office, Rob Martella was experimenting with various configurations of equipment brought back by Otano. A year after the first conference with Boyne, Otano's assiduous apprenticeship and Martella's diligent testing yielded a working prototype.

The storage system begins with an easel, illuminated by two high-intensity quartz lights, with the digitizing camera aimed at it. A document or photograph is placed on the easel; the operator presses a button and captures the image digitally, then checks it on a high-resolution monitor. "The main reason we have the monitor is to be sure we don't record the thing upside down," says Otano. At this point the system also automatically assigns an access code number to the bit-mapped

> The Smithsonian's 300,000 photographs have all been recorded on three videodisks.

image. "The operator can also add comments. If the document is water-stained, faded, whatever, the operator can note that."

The image is stored on a Winchester hard disk in a PC and on a reel-tape backup. The disk is then transferred to an optical disk for easier transportation. If the acquisition session is taking place at a remote location, this optical disk is then sent back to the Air and Space Museum, where technicians will check several frames to be sure everything is okay. "If we find a mistake—say we lost half the disk for some reason—we can simply restore that from the reel backup," says Otano.

If everything checks out, the optical disk is sent to a mastering facility. A videodisk master is made, and videodisk copies can then be cranked out for $15 a piece. The Smithsonian then offers them for sale at $35 each, the profit going to recover development costs. Each videodisk can hold copies of 50,000 photographs or 100,000 documents on each side.

As of this writing the Smithsonian has not yet made a trip into the field, nor has it stored written documents, but it has started storing its own collection of photographs—some 300,000 have been recorded on three videodisks.

The photograph-accessing system consists of a videodisk driver program written by Visual Database Systems combined with dBASE II, which runs on an AT (Otano says an XT or compatible would work as well). Operation is simple: insert the

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"aircraft photos" videodisk, type an aircraft model number—say, B-17—and a list of 20 categories of B-17 photos pops up on the screen. Select the "battle-damaged" category, for example, and all 26 of

the museum's photographs of battered, blasted, and bombed B-17s roll past at 5 seconds per frame. Select the one you want, choose the print option, and a thermal printer spits out the image. The Air

and Space Museum already has several of these videodisk-PC-monitor-keyboard-printer setups in its research library in the museum's west wing. Scholars can tap in their requests and receive prints for 40 cents apiece. "The resolution is not perfect, but it is good enough for reproduction in a newspaper, and certainly good enough for most scholarly applications," says Otano.

But photographs do not a library, or even an archive, make. While it is a fairly simple task to capture and code photographs to render them accessible through *dBASE II* and a souped-up videodisk driver, the real challenge is doing the same with printed materials.

> With a few clicks, a half-million pages of papers can be encoded, dumped from buffer to buffer, and eventually stored on videodisks.

Indexing the Text

Suppose, for example, the Air and Space Museum uses this system to capture the papers of famed rocket scientist Werner Von Braun. This is a safe supposition—museum technicians plan to go to Huntsville, Alabama, in 1985 to do exactly that. With a few clicks, a half-million pages of Von Braun's scientific papers, correspondence with fellow engineers, and personal notes can be encoded, dumped from buffer to buffer, and eventually stored on videodisks. They will be in "rough order," since during the capturing process technicians tried to store the papers in some semblance of the order in which they were produced. But it is inexact, because assembling them in perfect chronological order would be time-consuming, and it would be impossible in the case of undated material.

So what we have now is a complete, compact, rather disordered collection of Von Braun's work on videodisk, and it is virtually inaccessible. Clearly, an index is needed— but how do you index a half-million frames of images? By translating the pictures of words into ASCII code. For

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this task Otano needed a fast, flexible, accurate optical character recognition program. He found one; again it was from Datacopy.

The frames are run through the OCR

program, and then the resulting ASCII code is run through an indexing program—Otano has chosen *XyIndex*. "Then you just select a word or phrase. If you want Von Braun's papers that refer to

V-2, just type V-2, and it will retrieve each place in the papers where the term is used," he says. "The system can be linked to give you either the ASCII translation or the original digital image-frame, or both."

Otano picks up a book. "This book is about balloons. It has been digitized and run through the OCR. We'll pick a word." He selects the word *Gulliver*, used by the author to describe the gigantic proportions of a particular balloon. "You just type that word in. The program gives you the chapter in which the word appears, then goes to

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the page and highlights the word." A page of ASCII-translated text pops up, and there is the highlighted word. If the reader cares to, he or she can also refer to the original bit-mapped image of the page. "You would want to see the original page if, for example, the OCR program had not been able to recognize some words, which would leave blanks in the ASCII translation," Otano explained.

The result of Otano and Martella's work is complete indexed text retrieval at minimum cost. "All along, what we have had in mind is the rural library with limited funds," says Otano. "We could have done it all with high-end, specialized stuff, but we worked hard to make the retrieval system totally off-the-shelf." A library can spend perhaps $10,000 for the accessing hardware and software, then purchase videodisks from the Air and Space Museum. The life's work of the Wright brothers can be squeezed onto a single disk and purchased for $35. For $350, a library could buy ten videodisks containing a set of 1 million Air and Space Museum photographs (actually, photograph-videodisk sales has already begun—some 300 have been sold so far). And if $10,000 is too steep a price, the library, or any individual, could use a modem to call up a database that Otano plans to put on-line as soon as enough text has been captured to make the

investment worthwhile.

Preserving the Past

As word about Otano's system spread along the international archival grapevine, administrators began flying to Washington and asking for demonstrations. "We had the British Museum look at it, Deutsches Museum, museums in Japan and Canada, all of the other Smithsonian museums—I hate to tell you this, but even the IRS has been by to look at it," says Boyne.

One of the more recent visitors was Susan K. Martin, director of the Milton S. Eisenhower Library at Johns Hopkins University in Baltimore. "I was very impressed," she says. "We have many of the same problems that the Smithsonian has with deterioration of older manuscripts. The [preservation] technique that's been used for the last 40 years is microfilming, but it is not anybody's favorite medium to use for research. The Smithsonian's system is much more flexible."

James Cogswell, head of circulation of Princeton University Library, agrees. "I have seen the two major advanced systems that the United States Government is putting together for mass storage: the one at the Air and Space Museum and the one at the Library of Congress. I was impressed by the fact that the Air and Space system is very much a hands-on system; it's being developed in-house by the museum's own people using their own

> Otano's system, with its automatic indexing, will provide easier access than the Library of Congress's.

expertise. The Library of Congress system is tackling a similar problem through contractors."

Cogswell says Otano's system, with its automatic indexing, will provide easier access than the Library of Congress's. But, he adds, "I can see both sides." He says Otano's system has a small enough universe—only Air and Space materials—to make automatic indexing work-

able. "But if you are working with the chaos that is all the world's publishing, you are going to need a human intermediary." Such an intermediary would, for example, make sure that materials on *theater* and *theatre* are grouped under the same heading.

Boyne says his original plan had been simply to develop a private system for his own museum. "But when we began to

hear the praise and the ideas rolling around in these other people's heads, we decided to seek a patent." The patent is now pending. If it is granted and licensed to manufacturers, Boyne says, the Air and Space Museum will simply plow any profits back into the work of the museum. Martin, among others, says she is "anxiously awaiting" the day when the system becomes available commercially so that one can be installed for use in her library.

Otano and Martella are still refining the basic system. Otano cruises through trade shows to find off-the-shelf camera elements, software, and monitors that yield higher resolution. Martella is especially excited about the possibility of vectorizing images of line drawings rather than bitmapping them. Using the AutoCAD program from AutoDesk, the drawings would be stored on disks as a series of equations rather than as bits. This vectorizing takes up less storage space and also permits easy modification of the drawings. "We had a

> Pundits have predicted a paperless world for years, but our planet overflows with accumulated documents.

guy in here who wanted to use a system like this for skeletons," says Martella. "With AutoCAD, he could not only keep a huge file of skeletons, but he could also stretch and change the bones and view the image from different angles."

A Bridge from Paper to Disks
History will judge the significance of the work going on in the basement of the Air and Space Museum, but one implication is obvious. Pundits have proclaimed the coming of a paperless world for years, but our planet overflows with documents that have accumulated for centuries. To make the leap into paperlessness would require us either to abandon our written past or conscript millions of keypunchers to type everything into ASCII code. Otano's work points the way to a third alternative—automated ASCII translation combined with mass storage and easy retrieval. With further refinements of the technology, especially in the sophistication of OCR and indexing software, a variation on the Air and Space Museum's system could someday provide the crucial bridge between ink and electrons.

And in the meantime, the gratitude of scholars will be boundless. ∎

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A Bar Chart For All Reasons

With these six programs and the customizing modifications you can make to them, you can create bar charts to display nearly any two-axis data.

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Writing a program to draw a bar chart is more than a matter of drawing a few rectangles. First, the values that are to be represented by the bars must be scaled to fit the graphics screen. More calculations are then necessary to determine the magnitude and placement of the values in the vertical axis and of the titles in the horizontal axis. And finally, a good program must allow for enlargement and reduction of the entire chart.

This month's column presents six programs you can use to construct six different types of bar charts. While the programs are ready to use as is, I have also included an explanation of the methods employed, so you can easily customize them. Indeed, you will find that most of the calculations used in these programs can be directly applied to almost any graphic figure in which data is displayed along two axes, for example, to functions, lines, and flooded regions.

Scaling the Bars

Any useful bar chart program must be able to scale a wide variation in values so that the bars can be meaningfully displayed on the computer screen. To facilitate explanation, let us first suppose all the values to be represented are positive. In such a case, with a value of zero presents no problem, very small numbers and numbers larger than 199 (the height of the IBM PC screen) must be scaled. It is necessary to find a factor that, when multiplied by the largest value, yields 199. By simple algebra, this requirement is met by FACTOR = 199/MAXIMUM. If all the numbers are multiplied by FACTOR, the maximum

value will become 199, zero will still be zero, and the rest of the numbers will be scaled accordingly.

The point 0,0 is at the top-left corner of the screen, and positive vertical components grow downward. This would cause the bar chart to appear upside down. To straighten it up, you just subtract every vertical component from the maximum value that a point may have in the vertical axis. If the bottom of the bars must be at the 199th line, the subtraction 199 − Y for every value of Y results in a bar chart with the correct visual orientation.

The previous calculation assures that the largest bar will extend to the full height of the screen. This, however, is not always convenient. Suppose, for example, that the values to be shown are 998, 999, and 1000. The 1000 will be represented by a bar exactly 199 pixels high, but the others will have practically the same height. A

Illustration: Peter Siu

second type of scale mapping is thus necessary to adjust the minimum value for the bottom of the screen. Obviously, the smallest value should produce the lowest bar. If the value of the minimum bar is subtracted from all the values, the minimum becomes zero (MIN−MIN=0) and all the other numbers are shifted an equal amount. The scaling factor should be calculated not from the maximum value alone but rather by using the maximum minus the minimum, that is, using the distance between the largest and the smallest numbers (MAX−MIN).

In summary, here are the steps necessary to scale the numbers, taking into account the minimum and the maximum:

1. Find the distance between the largest and smallest numbers (D=MAX−MIN).

2. Find the scaling factor (FACTOR =SCREEN.BOTTOM/D).

3. Subtract the smallest number from every number.

4. Multiply every resulting number by the factor.

Program 1: Getting Started

The rather simple bar chart program listed in Program 1 incorporates these principles. You will note that in step 2 the factor is found not with the absolute bottom of the screen (199) but with the value SCREEN.BOTTOM. This permits constructing graphs of varying heights. The screen is 200 pixels high and the horizontal axis is drawn in the 199th line, but the scaling is done in Program 1 as if it were only 190 pixels high. This is done so that the smallest number will not be represented by a line (a degenerate bar) that lies on the horizontal axis, but rather as a small bar that stands above the x-axis by exactly 10 pixels.

To find the smallest number, the variable MAX is originally set to the value −INF (actually, −1.7E+38, a value very close to the smallest number that can be represented in floating-point variables). This ensures that any usable number will be larger than the original MAX. In line 80 every S(I) is compared with the current maximum, and at the end of the loop (lines 70 through 110), the largest value in S will be in MAX. Similarly, the variable MIN is initialized with the value +INF, and at the end of the loop, the smallest value that is

```
0 '** Program 1 **
10 INF=1.7E+38    'Infinity
20 SCREEN 1:CLS    'Set graphics mode
30 INPUT"Number of bars";N:IF N<2 THEN 30
40 DIM S(N)    'Set space for N values
50 MAX=-INF    'Set maximum to minus infinity
60 MIN=INF    'Set minimum to infinity
70 FOR I=1 TO N
80    INPUT"Bar value";S(I)
90    IF S(I)>MAX THEN MAX=S(I)
100   IF S(I)<MIN THEN MIN=S(I)
110 NEXT
120 IF MIN=MAX THEN PRINT"All the numbers are the same.":END
130 CLS
140 LINE(0,0)-(0,199)    'Y-axis
150 LINE(0,199)-(319,199)    'X-axis
160 DX=320/N    'Width of one column
170 WB=DX*.8    'Width of one bar
180 SPB=DX*.5-(WB*.5)    'Starting point of first bar
190 FACTOR=190/(MAX-MIN)    'Scaling factor
200 FOR I=1 TO N
210    HEIGHT=(S(I)-MIN)*FACTOR    'Height of bar
220    LINE(SPB,198-HEIGHT)-(SPB+WB,198),2,BF
230    LINE(SPB,198-HEIGHT)-(SPB+WB,198),3,B
240    NEXT
250 NEXT
260 WS=INPUT$(1)
                                            (Program 1 ends)
```

Program 1: A BASIC program to create a simple bar chart.

```
0 '*** Program 2 **
10 INF=1.7E+38    'Infinity
20 LM=40:RM=319:TM=3:BM=199    'Screen margins
30 IF INP THEN CLS:PRINT"The bottom margin is too large
   for":PRINT"the titles to fit. Use a larger one.":END
40 IF TM<3 THEN CLS:PRINT"The top margin is too small
   for":PRINT"the titles to fit. Use a larger one.":END
50 SCREEN 0:WIDTH 80:CLS    'Set graphics mode
60 INPUT"Number of vertical axis ";NV:IF NV<2 THEN 60
70 INPUT"Number of bars ";N:IF N<2 THEN 60
80 DIM S(N),T$(N)    'Set space for N values and titles
90 DIM N(200),N(200)    'Temporary arrays for GET and PUT
100 MAX=-INF    'Set maximum to minus infinity
110 MIN=INF    'Set minimum to infinity
120 FOR I=1 TO N
130   INPUT"Title, Value ";T$(I),S(I)
140   IF S(I)>MAX THEN MAX=S(I)
150   IF S(I)<MIN THEN MIN=S(I)
160 NEXT
170 IF MIN=MAX THEN PRINT"All numbers are the same.":END
180 'Find longest title
190 LNG1=LEN(STR$(INT(MAX))):IF MAX=0 THEN LNG1=LNG1-1
200 LNG2=LEN(STR$(INT(MIN))):IF MIN<0 THEN LNG2=LNG2-1
210 IF LNG1>LNG2 THEN MAXLEN=LNG1 ELSE MAXLEN=LNG2    'Find
       length of longest value
220 IF MAXLEN*8>2*LM THEN CLS:PRINT"The left margin is too small
       for the":PRINT"values to fit. Use a larger one.":END
230 'Draw chart
240 SCREEN 1
250 LINE(LM,TM)-(LM,BM)    'Y-axis
260 LINE(LM,BM)-(RM,BM)    'X-axis
270 WC=(RM-LM+1)/N    'Width of one column
280 WB=WC*.8
290 MWT=WB*.8    'Maximum width of titles
300 SPB=LM+WC*.5-(WB*.5)    'Starting point of first bar
310 CC=SPB+WB/2    'Center of first column
320 BW=BM-TM+1    'Height of window
330 MYV=INT(BW*.95)    'Maximum vertical position
340 FACTOR=MYV/(MAX-MIN)    'Scaling factor for bars
                                            (continues)
```

Program 2: This program allows you to insert titles and values on the chart axes.

```
(continued)
350 DH=MAX-MIN                    'Distance between MIN and MAX
360 FV=1/(MV-1)                   'Factor to scale values
370 DY=MVP/(MV-1)                 'Vertical distance between values
380 PY=TM+MVP-3:PX=LM-2-HAXLEN*8 'Position of value
390 'Put values in vertical axis
400 FOR I=0 TO NV-1
410     T=INT(DF*FV*I+MIN)        'Value for Y axis
420     LOCATE 1,1:PRINT USING STRING$(MAXLEN,"#");T;
430     GET(0,0)-(MAXLEN*8-1,7),M 'Copy value in graphics form
440     LOCATE 1,1:PRINT SPACE$(MAXLEN);
450     DH=PY+3
460     PUT(PX,PY),M,PSET
470     FOR J=LM TO RM STEP 3     'Dotted line
480         PSET(J,DH)
490     NEXT
500     PY=PY-DY                  'Set vertical position for next value
510 NEXT
520 GET(0,0)-(200,7),N           'Copy top-left part of screen
530 'Put titles in horizontal axis
540 FOR I=1 TO N
550     LOCATE 1,1:T$=LEFT$(T$(I),WDT):PRINT T$;" "
560     L7=LEN(T$)*8             'Length of title, in pixels
570     GET(0,0)-(L7,7),M        'Copy title in graphics form
580     PUT(CC-L7/2,BM+2),M      'Put title in its place
590     CC=CC+WC
600 NEXT
610 LOCATE 1,1:PRINT SPACE$(20); 'Erase last title
620 PUT(0,0),N,PSET             'Restore axis and value
630 'Draw bars
640 FOR I=1 TO N
650     BEIGHT=(S(I)-MIN)*FACTOR  'Height of bar
660     LINE(SPB,MVP-BEIGHT+TM)-(SPB+WB,BM),2,BF
670     LINE(SPB,MVP-BEIGHT+TM)-(SPB+WB,BM),3,B
680     SPB=SPB+WC               'Set position of next bar
690 NEXT
700 WS=INPUT$(1)
                                              (Program 2 ends)
```

```
# '** Double bar chart: Program 3 **
10 INF=1.7E+38                   'Infinity
20 LM=50:RM=250:TM=30:BM=140     'Screen margins
30 IF RM>320 THEN CLS:PRINT"The bottom margin is too large
   for":PRINT"the titles to fit. Use a larger one.":END
40 IF TM<3 THEN CLS:PRINT"The top margin is too small
   for":PRINT"the titles to fit. Use a larger one.":END
50 SCREEN 0:WIDTH 80:CLS         'Set graphics mode
60 INPUT"Number of values in vertical axis";NV:IF NV<2 THEN 60
70 INPUT"Number of bars ";N:IF N<2 THEN 70
80 DIM S(N,2),T$(N)              'Set space for N values and title
90 DIM M(200),N(200)            'Temporary arrays for GET and PUT
100 MAX=-INF                     'Set maximum to minus infinity
110 MIN=INF                      'Set minimum to infinity
120 FOR I=1 TO N
130     INPUT"Title ";T$(I)
140     FOR J=1 TO 2
150         PRINT J;
160         INPUT"Value ";S(I,J)
170         IF S(I,J)>MAX THEN MAX=S(I,J)
180         IF S(I,J)<MIN THEN MIN=S(I,J)
190     NEXT
200 NEXT
210 IF MAX=MIN THEN PRINT"All numbers are the same.":END
220 'Find longest value
230 LNG1=LEN(STR$(INT(MAX)));IF MAX>=0 THEN LNG1=LNG1-1
240 LNG2=LEN(STR$(INT(MIN)));IF MIN>=0 THEN LNG2=LNG2-1
250 IF LNG1>LNG2 THEN MAXLEN=LNG1 ELSE MAXLEN=LNG2   'Find
                                              (continues)
```

Program 3: Overlapping bar charts can be created for easy visual comparison of information.

actually entered will be in MIN.

The axes are drawn in lines 140 and 150. The width of the screen is 320, and there are N numbers to be plotted; therefore, the screen should be thought of as divided into N columns, each one with room for one bar. The width of every column is DX=320/N. The horizontal center of the first column is at the point DX*0.5. So that

A sample chart produced with Program 2.

adjacent bars don't touch, they should not have the same width as the columns, but rather, a fraction of it. In Program 1 they are 8/10 of one column, that is, DX*0.8. This value is copied in the variable WB (width of one bar). Supposing CC to be the horizontal center of the leftmost column (DX*0.5), the vertical walls of the first bar are at CC−(WB/2) and CC+(WB/2). In line 180 the variable SPB (starting point of bars) sets the horizontal coordinate of the left margin of the first bar; the second bar will start in SPB+DX, and the I-th bar in SPB+DX*(I−1).

Program 2: Scaling the Entire Chart

The second program adds a number of refinements to the simple program above. For example, in Program 2 the size of the entire chart can be modified. In addition, every bar is identified with a title, and the horizontal axis incorporates a set of values that helps clarify the relative magnitudes of the bars. While the smallest quantity displayed could be a negative number in Program 1, in the absence of a scale, there was no way to know that this was the case. Program 2 rectifies this deficiency.

The four variables that determine the left, right, top, and bottom margins of the graph are initialized in line 20. A change in any of these values will automatically be accompanied by an adjustment in the size

of the entire chart. The variable NV is set for the number of divisions in the vertical axis. If this value is 2, only the minimum and the maximum numbers will be displayed; if it is 3, a third value (the average of the minimum and minimum) will appear between the top and bottom margins. NV may be any number greater than 2, but if too many divisions are used, the numbers in the vertical axis will overlap. The array TS stores the titles that correspond to each bar. In lines 170 through 210, the lengths (number of characters) in the maximum and minimum titles are compared, and the length of the longest is stored in MAXLEN. This value is checked in order to ensure that there will be enough room between the left margin of the screen and the vertical axis and also to determine the format in which the numbers will be shown.

Characters produced by the PRINT statement can only be placed within character boundaries, that is, in one of the PC's 40 by 25 cells (80 by 25 in high resolution). This would be a prohibitive restriction. In Program 2, therefore, each number and title is first printed in the top-left corner of the screen, from whence it is copied in any array with the GET statement. The information in this array can then be treated as pure image data (not text) and so be placed exactly where it is needed on the screen.

To find the vertical scale of each number on the vertical scale, the maximum vertical point (MVP, calculated in line 330) is divided into the number of vertical divisions (NV − 1) and copied in DY. The first identifying number (at the bottom of the chart) is aligned with the top of the smallest bar, the height of which is TM + MVP (the top margin plus the maximum vertical point). Since characters are seven dots high, the first one is placed three pixels above the level of the smallest bar. The number at the bottom of the scale corresponds to the minimum bar and the top scale value corresponds to the maximum bar. The remaining scale numbers should be proportional to their vertical position. To achieve this, the intermediate numbers are scaled in the same way as the bars, with a maximum and a minimum (line 410). In Program 2 only the integer part of a number is displayed. If a fraction-

```
(continued)
      length of longest value
260 IF MAXLEN*8+2>LM THEN CLS:PRINT"The left margin is too small
      for the":PRINT"values to fit. Use  e larger one.":END
270 'Draw chart
280 SCREEN 1:CLS
290 LINE (LM,TM)-(LM,BM)          'Y-axis
300 LINE (LM,BM)-(RM,BM)          'X-axis
310 WC=(RM-LM+1)/N                'Width of one column
320 WB=WC*.8                      'Width of one bar
330 MWT=WB%8                      'Maximum width of titles
340 SPB=LM+WC*.5-(WB*.5)          'Position of first bar
350 CC=SPB+WB%2                   'Center of first column
360 IW=BM-TM+1                    'Height of window
370 MVP=INT(IW*.95)              'Maximum vertical point
380 FACTOR=MVP/(MAX-MIN)          'Scaling factor for bars
390 D=MAX-MIN                     'Distance between MIN and MAX
400 FV=1/(NV-1)                   'Factor to scale values
410 DY=MVP/(NV-1)                 'Vertical distance between values
420 PY=TM+MVP-3:PX=LM-2-MAXLEN*8  'Position of values
430 'Put values in vertical axis
440 FOR I=0 TO NV-1
450    T=INT(D*FV*I+MIN)          'Value for Y axis
460    LOCATE 1,1:PRINT USING STRING$(MAXLEN,"#");T
470    GET(8,8)-(MAXLEN*8-1,7),M  'Copy value in graphics form
480    LOCATE 1,1:PRINT SPACE$(MAXLEN)
490    DH=PY+3
500    PUT(PX,PY),M,PSET
510    FOR J=LM TO RM STEP 3       'Dotted line
520       PSET(J,DH)
530    NEXT
540    PY=PY-DY                    'Set vertical position for next value
550 NEXT
560 GET(8,8)-(208,7),N            'Copy top-left part of screen
570 'Put titles in horizontal axis
580 FOR I=1 TO N
590    LOCATE 1,1:T$=LEFT$(T$(I),MWT):PRINT T$;
600    LT=LEN(T$)*8               'Length of title, in pixels
610    GET(8,8)-(LT,7),M          'Copy title in graphics form
620    PUT(CC-LT%2,BM+2),M        'Put title in its place
630    CC=CC+WC
640    LOCATE 1,1:PRINT SPACE$(28);   'Erase last title
650    PUT(8,8),N,PSET             'Restore axis and value
660    FB=WB*.3                    'Fraction of bar to make them thinner
670 'Draw bars
680 FOR J=1 TO 2
690    HEIGHT=(S(I,J)-MIN)*FACTOR  'Height of bar
700    ON J GOTO 730,770
710    X1=SPB:Y1=HVP-HEIGHT+TM:X2=SPB+WB-FB:Y2=BM
720    LINE(X1,Y1)-(X2,Y2),J,BF
730    LINE(X1,Y1)-(X2,Y2),3,B
740    GOTO 810
760    X1=SPB+FB:Y1=HVP-HEIGHT+TM:X2=SPB+WB:Y2=BM
770    LINE(X1,Y1)-(X2,Y2),J,BF
780    LINE(X1,Y1)-(X2,Y2),3,B
790 NEXT
800    SPB=SPB+WC                  'Set position of next bar
810 NEXT
820 WS=INPUT$(1)

(Program 3 ends)
```

```
# '** Solid Bar chart: Program 4 **
10 INF=1.7E+38                     'Infinity
20 LM=68:RM=305:TM=12:BM=170       'Screen margins
30 IF BM>190 THEN CLS:PRINT"The bottom margin is too large
     for":PRINT"the titles to fit. Use a larger one.":END
40 IF TM<3 THEN CLS:PRINT"The top margin is too small
     for":PRINT"the titles to fit. Use a larger one.":END
50 SCREEN 2:WIDTH 80              'Set graphic mode

(continues)
```

Program 4: A BASIC program to create a 3-dimensional image.

(continued)

```
60  INPUT"Number of values in vertical axis ";NV:IF NV<2 THEN 60
70  INPUT"Number of bars ";N:IF N<2 THEN 70
80  DIM S(N),T$(N)          'Set space for N values and titles
90  DIM M(200),N(200)       'Temporary arrays for GET and PUT
100 MAX=-INF                'Set maximum to minus infinity
110 MIN=INF                 'Set minimum to infinity
120 FOR I=1 TO N
130   INPUT"Title, value ";T$(I),S(I)
140   IF S(I)>MAX THEN MAX=S(I)
150   IF S(I)<MIN THEN MIN=S(I)
160 NEXT
170 IF MIN=MAX THEN PRINT"All numbers are the same.":END
180 'Find longest value
190 LNG1=LEN (STR$(INT(MAX))) :IF MAX>0 THEN LNG1=LNG1-1
200 LNG2=LEN (STR$(INT(MIN))) :IF MIN>0 THEN LNG2=LNG2-1
210 IF LNG1>LNG2 THEN MAXLEN=LNG1 ELSE MAXLEN=LNG2   'Find
220 'length of longest value
230 IF MAXLEN*8>2*LM THEN CLS:PRINT "The left margin is too small
        for the":PRINT"values to fit. Use a larger one.":END
240 'Draw chart
250 SCREEN 1:CLS
260 WC=(RM-LM+1)/N          'Width of one column
270 WB=WC*.8                'Width of one bar
280 MWT=WB/8                'Maximum width of titles
290 SPB=LM+WC*.5-(WB*.5)    'Starting point of first bar
300 CC=SPB+WB\2             'Center of first column
310 BM=BM-TM+1
320 HW=BM-TM+1              'Height of window
330 MVP=INT(HW*.95)         'Maximum vertical point
340 FACTOR=MVP/(MAX-MIN)    'Scaling factor for bars
350 D=MAX-MIN               'Distance between MIN and MAX
360 FV=L/(NV-1)             'Factor to scale values
370 DV=MVP/(NV-1)           'Vertical distance between values
380 PY=TM+MVP-1:PX=LM-2-MAXLEN*8   'Position of values
390 'Put titles in horizontal axis
400 FOR I=1 TO N
410   LOCATE 1,1;T$=LEFT$(T$(I),MWT):PRINT T$;" "
420   LT=LEN(T$)*8          'Length of title, in pixels
430   GET(0,0)-(LT,8),M     'Copy title in graphics form
440   PUT(CC-LT\2,BM+2),M   'Put title in its place
450   CC=CC+WC
460 NEXT
470 LOCATE 1,1:PRINT SPACE$(20);   'Erase last title
480 'Draw bars
490 LINE(LM,TM)-(LM,BM)     'Y-axis
500 LINE(LM,BM)-(RM,BM)     'X-axis
510 FOR I=1 TO N
520   X1=SPB:Y1=MVP-BEIGHT=TM:X2=SPB+WB:Y2=BM
530   FOR J=8 TO 0 STEP -1
540     IF J>0 THEN LINE(X1+J,Y1-J)-(X2+J,Y2),,B
550     IF J=0 THEN COL=8 ELSE COL=3
560     LINE(X1+J,Y1-J)-(X2+J,Y2-J),COL,B
570     PSET(X2+J,Y1-J),0
580     PSET(X1+J,Y1-J),0
590   NEXT
600   SPB=SPB+WC            'Set position of next bar
610 NEXT
620 'Put values in vertical axis
630 FOR J=0 TO NV-1
640   T=INT(D*FV*J+MIN)     'Value for Y axis
650   LOCATE 1,1:PRINT USING STRING$(MAXLEN,"#");T;
660   GET(0,0)-(MAXLEN*8-1,7),M   'Copy value in graphics form
670   LOCATE 1,1:PRINT SPACE$(MAXLEN)
680   PUT(PX,PY),M,PSET
690   FOR J=LM TO RM STEP 3   'Dotted line
700     PSET(J,DH)
710   NEXT
720   PY=PY-DY              'Set vertical position for next value
730 NEXT
740 W$=INPUT$(1)
```
(Program 4 ends)

al part is needed, change the formatting string of the PRINT USING statement to STRING$(MAXLEN,"#") + '.' + STRING$(ND,"#"), where ND is the number of decimal places shown.

To find the maximum length allowed for a title, Program 2 uses the width of a bar (WB). Since characters are eight pixels wide, every column can accommodate at the most WB/8 pixels. Every title is truncated to this maximum length in line 550, printed in text position 1,1, copied in the array M, and then placed in position in line 580. The variable CC (center of column) is

A sample chart produced with Program 3.

initialized with the horizontal component of the center of the first column; the title is centered by dividing the width of the title by two and subtracting the resulting number from CC. Since the center of the next column is exactly DX pixels to the right of the current one, the addition of line 590 leaves CC ready for the next title.

The bars are drawn as they were in Program 1, except that here the values of the left and top margins are added to the components of every bar.

Program 3: Multiple Bars

When two or more values relate to the same variable, representing them with overlapping bars makes their comparison very easy. To compare the monthly data of two years, for example, it is convenient to show the bars of one year overlapping those of the other, so that the two can be easily compared. Program 3 allows you to produce this kind of graphic.

Actually, very few changes are necessary to convert the previous program from single to double bars. First, an extra dimension must be added to the array in which the values are stored. In Program 3

the array S is dimensioned as S(N,2). Since the same title applies to both bars, the array T$ need not be changed. The maximum and minimum must be the largest and smallest of both sets of numbers.

A sample chart created with Program 4.

The vertical components of each bar are calculated as for single bars, but a small change in the calculation of the horizontal components is required. If the same horizontal components were used for both related bars, the larger would cover the smaller one completely. In Program 3, therefore, the variable FB (fraction of bar) is set to 3/10 the width of the bar. The horizontal components of the first bar are X1 and X2-FB (resulting in a bar 7/10 the width of those drawn in the previous programs). Similarly, the horizontal components of the second bar are X1+FB and X2—the same width as the first bar, but offset FB units to the right.

If you wish to display more than two overlapping bars, it is necessary to divide the width of one complete bar into the number of values there are for each title and then to use the resulting number as a guide in placing the narrow bars. However, experience shows that charts displaying more than three overlapping bars are often more confusing than illuminating.

Program 4: Solidifying the Bars

One of the most popular ways to display data is with charts using solid (three-dimensional) bars. Bars of this type can be produced with Program 4.

In Program 4 solid bars are created simply by drawing each bar several times while gradually changing its horizontal and vertical coordinates. The rectangles that make the sides of the bar are drawn with color 3 (white) in line 550. The care

```
0 '** Stacked bars: Program 5 **
10 INF=1.7E+36          'Infinity
20 LM=40:RM=319:TM=10:BM=190      'Screen margin
30 IF BM>190 THEN CLS:PRINT"The bottom margin is too large
    for":PRINT"the title to fit. Use a larger one.":END
40 IF TM<3 THEN CLS:PRINT"The top margin is too small
    for":PRINT"the titles to fit. Use a larger one.":END
50 SCREEN 1:WIDTH 80:CLS          'Set graphics mode
60 INPUT"Number of bars ";N:IF N<2 THEN 60
70 INPUT"Number of levels ";NL:IF NL<1 THEN 70
80 DIM M(N,NL),T$(N),T(N)    'Set space for N values,titles
    and totals
90 DIM S(200),M(200)         'temporary arrays for GET and PUT
100 MAX=-INF                 'Set maximum to minus infinity
110 MIN=0                    'Set minimum to zero for stacked bars
120 FOR I=1 TO N
130   PRINT I
140   INPUT"Title ";T$(I)
150   FOR J=1 TO NL
160     PRINT "Level ";J;
170     INPUT S(I,J)
180     IF S(I,J)<0 THEN PRINT"< 0 Illegal in Stacked bars.
        Reject.":GOTO 160
190     T(I)=T(I)+S(I,J)
200   NEXT
210   IF T(I)>MAX THEN MAX=T(I)
220 NEXT
230 'Find longest value
240 MAXLEN=LEN (STR$(INT(MAX))):IF MAX>=0 THEN MAXLEN=MAXLEN-1
250 IF MAXLEN*8+22LM THEN CLS:PRINT"The left margin is too small
    for the":PRINT"value to fit. Use a larger one.":END
260 'Draw chart
270 SCREEN 1:CLS
280 LINE (LM,TM)-(LM,BM)        'Y-axis
290 LINE (LM,BM)-(RM,BM)        'X-axis
300 WC=(RM-LM+1)/N              'Width of one column
310 WB=WC*.8                    'Width of one bar
320 MWT=WB\8                    'Maximum width of titles
330 SPB=LM+WC*.5-(WB*.5)        'Starting point of first bar
340 CC=SPB+WB\2                 'Center of first column
350 HW=BM-TM+1                  'Height of window
360 MVP=INT(HW*.95)             'Maximum vertical value
370 FACTOR=MVP/(MAX-MIN)        'Scaling factor for bars
380 D=MAX-MIN                   'Distance between MIN and MAX
390 FV=1/(NV-1)                 'Factor to scale values
400 DV=MVP/(NV-1)               'Vertical distance between values
410 PY=TM+MVP-3:PX=LM-2-MAXLEN*8  'Position of values
420 'Put values in vertical axis
430 FOR I=LM+2 TO RM STEP 3:PSET(I,B):NEXT
440 GET (LM-2,B)-(RM,B),N:CLS   'Dotted line
450 LINE (LM,TM)-(LM,BM)        'Y-axis
460 LINE (LM,BM)-(RM,BM)        'X-axis
470 F$=STRING$(MAXLEN,"#")
480 NA=MAX/HW
490 'Normalize numbers and find number of zeros
500 IF MA<1 THEN 540
510 WHILE INT(MA)>=10:MA=MA/10:R=R+1:WEND:B=MA
520 IF R>0 THEN F$=F$+"#.#"     'At least one decimal in the format
530 GOTO 560
540 WHILE INT(MA)<1:MA=MA*10:R=R-1:WEND:B=MA*.#01
550 F$=F$+".*+STRING$(ABS(R),"#")   'R zeros after the decimal
    point
560 IF B>=1.2 THEN 580 ELSE R=1:ST=10:IF R<=2 THEN F$=F$+"#"
570 GOTO 620
580 IF B>=5 THEN 610 ELSE ST=5          'Since step is 0.5, add
590 IF INSTR(B$,".")<>0 THEN F$=F$+"#"   'one decimal to format
600 GOTO 620
610 ST=1F
620 MAXLEN=LEN(F$)   'F$ is the format
630 IF MAXLEN*8+22LM THEN CLS:PRINT"The left margin is too small
                                                    (continues)
```

Program 5: This program segments and stacks bars vertically.

```
        for the";PRINT"values to fit.  Use a larger value.":END
650     'Print values
651     EX=18*(R-1)
660     A=MIN(R5*T*EX)
678     IF A<>INT(A)THEN A=INT(A)+1 ELSE A=INT(A)
670     WHILE A*R5*T*EX-MAX < .000001
700     T=A*R5*T*EX
710     M=MVP+TM-(M-MIN)*FACTOR
720     LINE(LM-L,Y),(LM+2,Y)
730     LOCATE 1,1:PRINT USING F5;T
740     GET(0,8)-(MAXLEN*8-1,7),M   'Copy value in graphics form
750     LOCATE 1,1:PRINT SPACE$(MAXLEN)
760     PUT(LM-MAXLEN*8-2,Y-3),M,PSET
770     A=A+1
780     WEND
790     GET(0,8N)-(288,7),N   'Copy top-left part of screen
800     'Put titles in horizontal axis
810     FOR I=1 TO N
820        LOCATE 1,1:T5=LEFT5(T5(I),MMT):PRINT T5;" "
830        LT=LEN(T5)*8    'Length of title, in pixels
840        GET(0,8)-(LT,7),M   'Copy title in graphics form
850        PUT(CC-LT*2,BM+2),M   'Put title in its place
860        CC=CC+WC
870     NEXT
880     LOCATE 1,1:PRINT SPACE$(28);    'Erase last title
890     PUT(0,8),N,PSET   'Restore axis and value
900     'Draw bars
910     FOR I=1 TO N
920        T=0
930        X1=SPW:X2=SPB+WB:Y2=BM
940        COL=2    'Color for first stacked bar
950        FOR J=1 TO NL
960           T=T+S(I,J)
970           HEIGHT=(T-MIN)*FACTOR   'Height of bar
980           Y1=MVP+TM-HEIGHT
990           LINE(X1,Y1)-(X2,Y2),COL,BF
1000          LINE(X1,Y1)-(X2,Y2),3,B
1010          Y2=Y1:COL=COL+1:IF COL=4 THEN COL=0
1020       NEXT
1030       SPB=SPB+WC    'Set position of next bar
1040    NEXT
1050    W5=INPUT5(1)
```

```
0 '** High resolution stacked bars: Program 6 **
10  INF=1.7E+38    'Infinity
20  LM=8:RM=635:TM=5:BM=190   'Screen margins
30  IF BM>190 THEN CLS:PRINT"The bottom margin is too large
        for":PRINT"the titles to fit. Use a larger one.":END
40  IF TM<3 THEN CLS:PRINT"The top margin is too small
        for":PRINT"the titles to fit. Use a larger one.":END
50  'Read patterns
60  READ NP    'Number of patterns
70  DIM P5(NP)
80  FOR I=1 TO NP
90     FOR J=1 TO 8
100       T=0
110       FOR K=1 TO 8
120          READ C:T=T+C*2^(8-K)
130       NEXT
140       P5(I)=P5(I)+CHR5(T)
150    NEXT
160 NEXT
170 SCREEN 2:WIDTH 80:CLS    'Set text mode
180 INPUT"Number of bars ";N:IF N<2 THEN 180
190 INPUT"Number of levels ";NL:IF NL<1 THEN 190
200 DIM S(N,NL),T5(N),T(NL)    'Set space for N values,titles
```

Program 2: This program can flood a bar chart with black-and-white patterns to differentiate one segment from another.

---

taken to erase the two top corners with black dots in lines 560 and 570 contributes greatly to the feeling of depth. The last bar is drawn with color 2 (when J=0 in line 530) to produce the front wall, and the frame is traced with black. Since the bars that correspond to the height of the horizontal dotted lines are the last to be drawn, the scale numbers and the dotted lines are added after all the bars have been finished.

Program 5: Stacked Bars

Instead of placing several sets of data with overlapping bars as in Program 3), greater clarity can sometimes be achieved by stacking one on top of the other. Program 5 gives you the means to achieve this. The screen shot illustrating Program 5 clearly shows that the largest of all the sets is represented with the darkest bars.

Since it is the actual magnitude of each number that is compared in this type of graph, it makes little sense to allow negative numbers. The minimum must be zero, and the maximum must be the number that corresponds to the largest complete bar. NL is the number of partial bars (segments) that make up a complete bar, so that the numbers represented in the first bar are $S(1,1), S(1,2), \ldots, S(1,NL)$. To calculate the vertical coordinates of the first partial bar, the number $S(1,1)$ is added to T (which originally contains zero). After the height is computed, Y1 is calculated in line 980. Y2, the bottom of the first partial bar, is equal to the bottom margin (BM). The bottom of the second segment of each bar coincides with the top of the first, so the value of Y1 is copied in Y2 (line 1010). The height of the second bar segment is calculated with T, which now contains $S(1,1)+S(1,2)$. The process is repeated for the remaining segments of the bars, with T always containing the sum of the previous numbers in the same bar.

You will notice, in the screen shot for Program 5, that the number scale along the vertical axis is not the same as in the previous charts. Instead of printing the largest number at the top and the smallest at the bottom, here the values are guides that do not show the exact values of the minimum and maximum but that give a very good idea of the relative magnitude of every bar. If the minimum is 0 and the maximum

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210, for example, instead of printing 0 and 210 at the extremes, with 105 in the middle (and further fractions of these numbers when more divisions are specified), the program simply displays the numbers 0, 50, 100, 150, and 200. To accomplish this, in Program 5 the largest number is normalized; that is, it is repeatedly multiplied (divided if the number is smaller than 1) by 10 until the integer part of the resulting number is between 0 and 10 (excluded). If the resulting number is between 1.2 and 5 (excluded), the number in the vertical axis are printed in steps of 0.5×10 followed by the normalized number of 0.5×100, that is, 50. Similarly, if the normalized number lies between 5 and 12 (excluded), the step

A sample chart created with Program 5.

will be 10.

In Program 5 the minimum is always zero; however, the routine that places the numbers along the vertical axis works equally well with negative and very small numbers. When the distance between the minimum and the maximum is smaller than 0.000001, the number at the end of the expression in line 680 must be adjusted accordingly.

Program 6: Flooding with Patterns

Program 5 used alternating colors to differentiate bar segments. This works perfectly on a color screen, but a different method must be used when the charts are printed or displayed in black and white. In Program 6 the chart is shown in high resolution (black and white). Since the size of the figure is controlled by the four variables that determine the margins

```
(continued)
    and totals
210 DIM M(200),N(200)       'Temporary arrays for GET and PUT
220 MAX=-INF                'Set maximum to minus infinity
230 MIN=0                   'Set minimum to zero for steckad bare
240 FOR I=1 TO N
250   PRINT I;
260   INPUT"title ";T$(I)
270   FOR J=1 TO ML
280     PRINT"  ";J;
290     INPUT S(I,J)
300     IF S(I,J)<0 THEN PRINT"< # illegal in stackad bare.
          Repeat ":GOTO 280
310     T(I)=T(I)+S(I,J)
320   NEXT
330   IF T(I)>MAX THEN MAX=T(I)
340 NEXT
350 'Find longest title
360 MAXLEN=LEN(STR$(MAX)):IF MAX>=8 THEN MAXLEN=MAXLEN+1
370 'Drew chart
380 SCREEN 2:CLS
390 LINE(LM,TM)-(LM,BM)      'Y-exie
400 LINE(LM,BM)-(RM,BM)      'X-exie
410 WC=(RM-LM+1)/N           'Width of one column
420 WB=WC*.8                 'Width of one bar
430 MWT=WB*$8                'Maximum width of titles
440 SFB=LM+WC*.5-(WB*.5)     'Starting point of first bar
450 CC=SFB+WB\2              'Centar of first column
460 BH=BM-TM+1               'Height of window
470 MVP=INT(BH*.95)          'Maximum vertical point
480 FACTOR=MVP/(MAX-MIN)     'Scaling factor for bars
490 D=MAX-MIN                'Dietance between MIN end MAX
500 PV=1/(MV-1)              'Factor to scale values
510 DV=MVP/(MV-1)            'Vertical distance between values
520 PY=TM+MVP-3:PX=LM-2-MAXLEN*8  'Position of valuee
530 'Put values in vertical exis
540 FOR I=LM+2 TO RM STEP 3:PSET(I,0):NEXT
550 GET(LM+2,0)-(RM,0),N:LCLS     'Dotted line
560 LINE(LM,BM)-(RM,BM)      'X-exie
570 LINE(LM,BM)-(RM,BM),"@"  'X-exie
580 F$=STRING$(MAXLEN,"@")
590 'Normalize numbers and find number of zeros
600 IF MA<1 THEN 650
610 WHILE INT(MA)>10:MA=MA*1E-1:R=R+1:WEND:B=MA
620 IF R>0 THEN F$=F$+"."       'At least one decimal in the format
630 IF R<0 THEN F$=F$+"0"
640 GOTO 670
650 WHILE INT(MA)<1:MA=MA*1E:R=R-1:WEND:B=MA*.001
660 F$=F$+"."+STRING$(ABS(R),"0")  'R zeros after the decimal
    point
670 IF B>=1.2 THEN 690 ELSE I=B-1:ST=10:IF R<-2 THEN F$=F$+"0"
680 GOTO 730
690 IF B>5 THEN 720 ELSE ST=5       'Since step is 8.5; add
700 IF INSTR(F$,".")<>0 THEN F$=F$+"0"   'one decimal to format
710 GOTO 730
720 ST=2
730 MAXLEN=LEN(F$)           'F$ is the format
740 IF MAXLEN*8+2>LM THEN CLS:PRINT"The left margin is too small
    for the":PRINT"values to fit.  Use a larger value.":END
750 'Print values
760 EX=10^(R-1)
770 A=MIN/(ST*EX)
780 IF A<>INT(A)THEN A=INT(A)+1 ELSE A=INT(A)
790 WHILE A*ST*EX<=MAX+.00001
800   T=A*ST*EX
810   Y=MVP+TM-(T-MIN)*FACTOR      'Number on exis
820   Y=MVP+TM-(T-MIN)*FACTOR      'Scaled height of number
830   LINE(LM-1,Y)-(LM+2,Y)        'Line in vertical exis
840   PUT(LM+2,Y),N                'Put dotted line
850   LOCATE  1,1:PRINT USING F$;T  'Print number
860   GET(8,0)-(MAXLEN*8-1,7),M    'Copy in graphics form
870   LOCATE 1,1:PRINT SPACES(MAXLEN)  'Erase number
880   PUT(LM-MAXLEN*8-2,Y-3),M,PSET  'Put number in its place
890   A=A+1                        'Increment for next number
```

```
(continued)
890 WEND
900 GET(0,0)-(200,7),N          'Copy top-left part of screen
910 'Put titles in horizontal axis
920 FOR I=1 TO N
930   LOCATE 1,1:PS=LEFT$(T$(I),MWT):PRINT TS;
940   LT=LEN(T$)*8               'Length of title, in pixels
950   GET(0,0)-(LT,7),M          'Copy title in graphics form
960   PUT(CC-LT/2,BH+2),M        'Put title in its
970   CC=CC+WC
980 NEXT
990 LOCATE 1,1:PRINT SPACE$(20); 'Erase last title
1000 PUT(0,0),N,PSET             'Restore axis and value
1010 'Draw bars
1020 FOR I=1 TO N
1030   T=0
1040   X1=SPB:X2=SPB+WB:Y2=BM
1050   LT=LEN(T$)*8
1060   PAT=1                     'Pattern for first stacked bar
1060   FOR J=1 TO NL
1070     T=T+S(I,J)
1080     HEIGHT=(T-MIN)*FACTOR   'Height of bar
1090     Y1=WV-T-HEIGHT
1100     LINE(X1,Y1)-(X2,Y2),0,BF
1110     LINE(X1,Y1)-(X2,Y2),1,B
1120     IF X2-X1>2 THEN PAINT(X1+2,Y1+1),P$(PAT),1
1130     Y2=Y1
1140     PAT=PAT+1:IF PAT>NP THEN PAT=1
1150   NEXT
1160   SPB=SPB+WC                'Set position of next bar
1170 NEXT
1180 WS=INPUT$(1)
2000 DATA 4:                     'Number of patterns
2010 'First Pattern
2020 DATA 1,0,0,0,0,0,0,0
2030 DATA 0,0,0,0,0,0,0,0
2040 DATA 0,0,1,0,0,0,1,0
2050 DATA 0,0,0,0,0,0,0,0
2060 DATA 1,0,0,0,1,0,0,0
2070 DATA 0,0,0,0,0,0,0,0
2080 DATA 0,0,1,0,0,0,1,0
2090 DATA 0,0,0,0,0,0,0,0
2100 'Second Pattern
2110 DATA 1,0,0,0,1,0,0,0
2120 DATA 0,1,0,0,0,1,0,0
2130 DATA 0,0,1,0,0,0,1,0
2140 DATA 0,0,0,1,0,0,0,1
2150 DATA 1,0,0,0,1,0,0,0
2160 DATA 0,1,0,0,0,1,0,0
2170 DATA 0,0,1,0,0,0,1,0
2180 DATA 0,0,0,1,0,0,0,1
2190 'Third pattern
2200 DATA 1,1,1,1,0,1,1,1
2210 DATA 1,1,1,1,1,1,1,1
2220 DATA 1,1,0,1,1,1,0,1
2230 DATA 1,1,1,1,1,1,1,1
2240 DATA 0,1,1,1,0,1,1,1
2250 DATA 1,1,1,1,1,1,1,1
2260 DATA 1,1,0,1,1,1,0,1
2270 DATA 1,1,1,1,1,1,1,1
2280 'Fourth pattern
2290 DATA 1,0,0,0,0,0,0,1
2300 DATA 0,0,0,0,0,1,1,0
2310 DATA 0,0,0,1,1,0,0,0
2320 DATA 0,1,1,0,0,0,0,0
2330 DATA 1,0,0,0,0,0,0,1
2340 DATA 0,0,0,0,0,1,1,0
2350 DATA 0,0,0,1,1,0,0,0
2360 DATA 0,1,1,0,0,0,0,0
```

(Program 6 ends)

(LM,RM,TP, and BM), a simple change in the right margin adjusts the graph to the new screen size.

The PAINT statement of version 2.x of BASICA can flood a shape with a given pattern. (While this statement existed in earlier versions, it could only fill with solid

A sample chart created with Program 6.

colors). The format of this statement is:

$$PAINT (X,Y), CHR\$(N1) + CHR\$(N2) + ... + CHR\$(N8), C$$

where X,Y determines the point at which the flooding starts, the string CHR$(N1)+...defines the pattern, and C determines the bordering color, that is, the color that will halt the flooding. In high resolution the pattern is 8 pixels wide (one byte wide; every bit corresponds to a pixel), by anywhere from 1 to 64 pixels high. In Program 6, I chose to use patterns of exactly 8×8 pixels (à la Macintosh). In the DATA statements that begin in line 2000, every pixel is represented by a zero (black) or a one (white). These numbers are converted into the corresponding byte value in line 120, so that the entire 1-bit pattern is in PS(I). In medium resolution, the patterns can only be four dots wide, since it takes 2 pixels to represent the four colors available in this mode. The BASIC manual explains this in detail.

After working with these six programs for a while, you'll be able to acquire a "feel" for which format and what modifications will be best for displaying nearly any two-axis data. Keying them in is a chore you can avoid by downloading them from *PC*'s Interactive Reader Service at (212) 696-0360. ∎

Gabriel Cuellar is the author of Graphics Made Easy *for the IBM PC.*

Spreadsheet Clinic

Several months ago we ran two editions of Spreadsheet Clinic and were inundated by enthusiastic reader response. This double-length installment marks the return of an ongoing column.

Leaving a Hole for a Variable

It's useful to be able to put variables into a macro. The trick is to put a "hole" in the macro, which is filled before the macro executes.

The example shown in Figure 1 involves two simple macros. You could use it as part of a procedure to input monthly data according to a standard format and save the data with the name of the month as the filename.

The first macro prompts for the name of the month and stores the name in cell C1. After you have entered all the data for that month, you invoke the second macro, which copies the name of the month into the "hole" in cell A3. The macro then does a file save, using the name of the month as the filename.

The key to using variables in macros is to understand that single commands can be spread over several cells. The file save command that starts in cell A2 doesn't end until cell A4. This is what lets you put a variable in cell A3.

Figure 2 is a more complex example, which you might use to adjust all the numbers in a column of figures by multiplying them by a constant. The macro prompts for the constant and the address of the column of figures, and away it goes. The range name routine (cells AA6 through AA8) that stops the macro at the last number in the column is from LeBlond and Cobb's book, *Using 1-2-3*.

Paul Jespen
Bloomington, Minnesota

This is one of those tricks that's so handy you wonder how you did without it. An ex-

ample in User-to-User (PC, Volume 3 Number 18) used this technique but didn't elaborate on the principle.

The macro in Figure 2 could be made even more flexible if there were a third prompt that supplied the operation to be performed on the column of figures (in this case the * in cell AA9). Any of the arithmetic operators would work. There's nothing to stop you from slinging as many variables as you like into your macros.

Monday Through Friday

In the March 19 Spreadsheet Clinic (PC, Volume 4 Number 6), Robert Novak outlined a method to make 1-2-3 or Symphony list weekdays only. Although this may smack of "my worksheet is better than your worksheet," there is a much faster way to do it.

Enter the serial number for the first date in cell C3. In cell C4, enter this formula:

+C3+@IF(@MOD(C3,7)=6,3,1)

```
First Macro

Cell A1   /xlWhat is the month of this budget? : ~C1

Second Macro

Cell A1   /cell'A3'
Cell A2   /fs
Cell A3
Cell A4
```

Figure 1: *This procedure creates a slot that can be filled with variable information.*

```
Third Macro

Cell AA1   /xlWhat is the adjustment? : ~AA10    Prompts for value and stores it in cell AA10
Cell AA2   /xlWhat is the column? : ~AA4~        Prompts for address of column to adjust, stores in AA4
Cell AA3   {goto}                                Begin move-cursor command
Cell AA4                                         'Hole' in macro (will contain cell address)
Cell AA5   ~                                     Finish move-cursor command
Cell AA6   /RNCTEMP~                             Begin range-name sequence
Cell AA7   /XITEMP=0~/RNOTEMP~/RGAA15~           Name column to
Cell AA8   /RNDTEMP~                             at least value in column
Cell AA9   {edit}*                               Edit cell formula and prepare to multiply
Cell AA10                                        'hole' in macro (to be filled by adjustment value)
Cell AA11  ~                                     Finish multiplication
Cell AA12  {edit}{calc}                          Change formula into absolute number
Cell AA13  {down}                                Move to next number in column
Cell AA14  /xgAA6~                               Goto AA6
```

Figure 2: *This macro carries out an arithmetic function with the constant and cell addresses supplied by the user.*

225

Copy this formula as far down the column as you like. With the date display format, you will get a list of weekday dates, as:

```
04-Apr-85
05-Apr-85
08-Apr-85
09-Apr-85
```

The formula works like this: If the value of @MOD(C3,7) (the remainder off the serial number in cell C3 divided by 7) is 6, then that date is a Friday, as Mr. Novak explained. This means that you must add 3 to the date in cell C3 to get the next date, Monday. If the value of @MOD(C3,7) is not equal to 6, you just add 1 for the next day of the week.

If you are using *Symphony*, you can also use the @CHOOSE function to print the day of the week, as:

```
05-Apr-85    Thu
05-Apr-85    Fri
08-Apr-85    Mon
09-Apr-85    Tue
```

The following formula, copied as far down as you like, will do the job:

@CHOOSE(@MOD(C3,7),@ERR,
@ERR,"Mon","Tue","Wed",
"Thu","Fri")
Stan Scott
New York, New York

Yep, that's a much better solution to the problem. And no need to be shy. If your worksheet is better than our worksheet we want to hear about it.

Subdirectory Menus

I've discovered a relatively simple way, using menu macros, to choose subdirectories from *1-2-3* at the touch of a button. This is a great convenience for hard disk users who keep different *1-2-3* files in different subdirectories. If the file containing the menu macros is called AUTO123.WKS, and the initial macro is \0 (backslash zero), you get a menu of options as soon as you enter *1-2-3*.

Figure 3 contains the complete macro, with explanations in column A. The long prompts in lines 31 and 42 have been shortened to fit the page, but they can be as long as will fit on the second row of the menu.

The first menu lets you retrieve files

from any of six different directories or, in column H, gives you the option of creating a new file for any of those six subdirectories. In either case, the macro changes *1-2-3*'s default directory according to the menu selection, and you end up with an old file to work with (line 34) or a blank screen in which to create a new one (line 45).

Since *1-2-3* menus allow no more than eight choices, this macro, in its simplest form, lets you choose from only eight subdirectories. But, if you name the last menu selection "More" you can use it to call up another menu of subdirectories.

Rick Vosik
Omaha, Nebraska

A nice way to start the day.

Labeling the Lines in a Line Chart

1-2-3 line charts usually look something like Figure 4: the lines are distinguished from each other by little squares, pluses, or other symbols at the data points. Not only do the symbols clutter up the graph, but you have to look at the legend at the bottom to figure out which line is which.

The same graph is cleaner and easier to read if you can get *1-2-3* to make it look

```
        21                          A       B    C           D            E           F        G      H
        22   MACRO \0 -------->              /xmMENU~
        23   AUTOMATICALLY CALLS UP
        24   THE MENU CALLED "MENU"
        25   WHICH IS IN RANGE
        26   B30 TO H34
        27
        28
        29   MENU:
        30   SHORT PROMPT ------->              C:   A:   Accounting   Marketing    Personal    Bill's       New File
        31   LONG PROMPT -------->              Root Floppy EXPLANATION EXPLANATION  EXPLANATION EXPLANATION  Start a New File
        32   FILE DIRECTORY COMMAND ->          /FD  /FD  /FD          /FD          /FD         /FD          /xmmenu2~
        33   NAME OF CORRESP. DIRECTORY ->      C:\  A:\  C:\accntg    C:\market    C:\personal C:\bill
        34   ALLOW USER TO RETRIEVE FILE ->     /FR  /FR  /FR          /FR          /FR         /FR
        35   FROM DIRECTORY WITH
        36   FILE RETRIEVE COMMAND
        37
        38   THIS IS MENU 2 (RANGE B41 TO G45)
        39   WHICH IS CALLED BY New File
        40   IT'S FOR CREATING NEW FILES
        41   SHORT PROMPT ------->              C:   A:   Accounting   Marketing    Personal    Bill's
        42   LONG PROMPT -------->              Root Floppy EXPLANATION EXPLANATION  EXPLANATION EXPLANATION
        43   FILE DIRECTORY COMMAND ->          /FD  /FD  /FD          /FD          /FD         /FD
        44   NAME OF CORRESP. DIRECTORY ->      C:\  A:\  C:\accntg    C:\market    C:\personal C:\bill
        45   ERASES WORKSHEET ----->            /wey /wey /wey         /wey         /wey        /wey
        46   SO USER CAN CREATE HIS OWN
```

Figure 3: *A menu macro that allows the user to choose subdirectories from 1-2-3.*

like Figure 5. There's no obvious way to do that, though, because Lotus will not put your text anywhere you like in a graph. The trick is to fool *1-2-3* into thinking that your line labels are data labels.

The program lets you label every data point on the graph with a block of text. (The text would replace the pluses and boxes in Figure 4.) In this case, you only want *one* data label per line. Use the /GOD command to set up two dummy ranges of data labels, as in Figure 6. The data-label range for the Defense Spending data range is in cells B9..B19 and the one for Transfer Payments is in cells C9..C19.
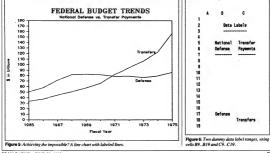
Note that in each range, all but one cell is blank; you want a "data label" for only one data point. Note also that the further down the range column the data label is, the further to the right on the chart the label will appear. You can avoid having the label break the graph line by playing around with its position when *1-2-3* prompts you for the position of the data label. In this case "Transfers" is to the left of the data point for 1974, and "Defense" is under the data point for 1973.

Get rid of the boxes and pluses of Figure 4 with the /GOFGL command, wipe out the legends at the bottom, and you've got yourself a snappy-looking Figure 5.

Greg Schulte
Arlington, Virginia

With all the slick graphics packages now available (see PC Magazine, *Volume 4 Number 12), 1-2-3's feeble-looking charts need all the help they can get.*

Figure 4: *A sample of 1-2-3's standard box-and-plus line chart.*

Figure 5: *Achieving the impossible? A line chart with labeled lines.*

Figure 6: *Two dummy data label ranges, using cells B9..B19 and C9..C19.*

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Awesome advice,

☞Denotes IBM-AT compatibility.

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Embedding Printer Codes in 1-2-3 Worksheets

It's possible to print out a *1-2-3* worksheet with different type faces in different places. By breaking the worksheet up into ranges and printing each range sequentially with a different printer setup string, you can have double-width titles, bold-face footnotes, and so forth. However, printing in chunks is tedious business. Clearly, if you could put the printer codes within the worksheet exactly where you wanted them, you could print the whole worksheet in one piece.

I have written a BASIC program (see Figure 7) that creates a file of printer codes that can be read right into your worksheet. Once you have the codes, you can copy them wherever you like within the worksheet and thus control the printer from any cell.

This program contains control codes for the Epson series of printers, but since it is in BASIC, you can easily rewrite it to suit your own printer. You only need to run it once: It will create a small file called 123PRINT.PRN. Read it into your spreadsheet with the /File Import Numbers command, and you will get something that looks like Figure 8.

The left-hand column contains the control codes, and the right-hand column identifies their functions. To single out a word in your spreadsheet that prints in italics, copy the italics control codes to the cell where you want italics:

←4XXX←5

In this example, ← represents the left arrow that appears in the spreadsheet as the "escape" symbol. Then edit that cell, replacing XXX with your text.

Since ←4 turns on italics and ←5 turns it off, only the text sandwiched between them will be italicized. If you want a whole block of text in italics, delete ←5 from the end of the cell. Write your text. Then copy the control codes once again, this time to the point where you want italics to end, and edit out everything but ←5.

If you want to use combined print modes, such as emphasized italics or double-strike compressed, you can custom build the proper control codes by using the string of escape (←) symbols that I have provided. For emphasized italics, copy the

string of escapes to the cell where you want the text, and add characters and delete escapes until it looks like this:

←E←4 TEXT GOES HERE ←5→F

The program also gives you a "compress" symbol followed by a string of escapes, because that symbol, too, is not a regular character. Use that code for combined modes that include compression.

Since the 123PRINT.PRN file is so

```
10 ' Program to create print codes for the Epson series printers
20 ' to be used in individual cells in Lotus 1-2-3
30 '
40 X$="XXX"
50 E$=CHR$(27)      : CTRLO$=CHR$(15)  : CTRLR$=CHR$(18)
60 ZERO$=CHR$(0)    : ONE$=CHR$(1)     : TWO$=CHR$(2)
70 THREE$=CHR$(3)   : FOUR$=CHR$(4)    : FIVE$=CHR$(5)
80 SIX$=CHR$(6)     : SEVEN$=CHR$(7)   : EIGHT$=CHR$(8)
90 '
100 ' To use in 123, substitute text for XXX
110 '
120 CON$   = CTRLO$        + X$ + CTRLR$               'condensed on, off
130 WIDE$  = E$ + "W1" + X$ + E$ + "W0"                'wide on, off
140 EMPH$  = E$ + "E"  + X$ + E$ + "F"                 'emphasized on, off
150 DOUBLE$= E$ + "G"  + X$ + E$ + "H"                 'double strike on, off
160 ITALIC$= E$ + "4"  + X$ + E$ + "5"                 'italic on, off
170 UNDER$ = E$ + "-1" + X$ + E$ + "-0"                'underline on, off
180 SUPER$ = E$ + "S0" + X$ + E$ + "T"                 'superscript on, off
190 SUB$   = E$ + "S1" + X$ + E$ + "T"                 'subscript on, off
200 ELITE$ = E$ + "M"  + X$ + E$ + "P"                 'elite on, off
210 ESCS$  = E$+E$+E$+E$+E$+E$+E$+E$+E$                'escapes
220 CONESCS$ = CTRLO$+E$+E$+E$+E$+E$+E$+E$+E$+E$+E$+CTRLR$
230 '                                                  'condensed + escapes
240 '
250 BACK$  = EIGHT$                                    'backspace 1 character
260 MANYBACK$=EIGHT$+EIGHT$+EIGHT$+EIGHT$+EIGHT$       'backspace many characters
270 BELL$  = SEVEN$                                    'ring bell
280 FILE$  = "b:123print.prn"
290 OPEN FILE$ FOR OUTPUT AS #1
300 WRITE #1,CON$,"condensed"
310 WRITE #1,WIDE$,"wide"
320 WRITE #1,EMPH$,"emphasized"
330 WRITE #1,DOUBLE$,"double strike"
340 WRITE #1,ITALIC$,"italics"
350 WRITE #1,UNDER$,"underline"
360 WRITE #1,SUPER$,"superscript"
370 WRITE #1,SUB$,"subscript"
380 WRITE #1,ELITE$,"elite print"
390 WRITE #1,BACK$,"backspace"
400 WRITE #1,MANYBACK$,"several backspaces"
410 WRITE #1,BELL$,"bell"
420 WRITE #1,ESCS$,"escapes"
430 WRITE #1,CONESCS$,"condensed + escapes"
440 CLOSE
450 END
```

Figure 7: *A BASIC program that creates the file 123PRINT.PRN.*

small, you can copy it onto your *1-2-3* master disk and read it into a worksheet whenever you need it.

Judith R. Epstein
Highland Park, Illinois

This is the slickest trick I've seen in a while. And it lets you do a lot more than give your printer a workout. By putting a backspace between two characters, for example, you can overstrike your zeros with backslashes, or combine a Y and an = to make a yen currency symbol.

It's nice to have the beep code, too. Put a few at the end of a big worksheet the next time you decide to print it. So long as you stay within earshot, you can go off and do something else until the printer calls and tells you it's finished printing.

Bug in Subroutine Call

There's a little-known bug in the call-and-return feature of *1-2-3*'s programming language. When a keyboard macro contains a subroutine call (/X*location*), *1-2-3* jumps to a new location and begins taking keystrokes from that location until it reaches a subroutine return (/XR). *1-2-3* will then return to the subroutine call, and execution continues from the point immediately after the call.

Unfortunately, the location of the call is saved as an absolute storage address. If you call a subroutine that inserts (or deletes) a row (/Worksheet Insert Row or /Worksheet Delete Row) above the call, *1-2-3* fails to adjust the storage address to reflect the addition or subtraction of rows. Thus, when *1-2-3* returns from the subroutine, it returns to the wrong cell, and as the macro continues to execute, it will play back the wrong keystrokes!

I know of only one solution: Put all macros using subroutine calls above any data areas where you will be inserting and deleting lines. This means all your databases must be near the bottom of the worksheet, not near the top. This is an ugly fix, but at least you can use the Auto-Execute macro (\0) to put the cursor at the top of the data area when you load the worksheet.

Edward Nisley
Poughkeepsie, New York

Ouch! It's not hard to imagine the frustration that led to this discovery. Never hav-

> With one simple macro, 1-2-3 will print every file on your disk while you do something more exciting.

ing written a macro that inserted or deleted lines, I tried it out with simple GOTOs as well as subroutine calls. You get the same problem both ways.

Does anybody out there know more about this problem? Any fixes?

Continuous Printing of Files

Printing all the files on a disk is a monotonous chore. But with one simple macro, *1-2-3* will print every file on your disk while you go away and do something more exciting. The trick is to put this little macro in each file on the disk:

```
/ppagpq ; print file and re-
          align paper
/fe^^ y ; delete file you just
          printed
/fr^ ; retrieve next file
```

The next time you need to print out all the files, go through them and change the name of this macro to \0 so that it autoexecutes. (You might give it a different name in the first file just to maintain some control.) Since this series of macros will eventually leave you with a blank disk, copy all your data files to a new disk. Then invoke the macro on the first file and take a coffee break while the files print out unattended.

Aditya M. Sharma
Mississauga, Ontario
Canada

I racked my brains trying to think of an easy way to get rid of line 2 of the macro that erases the file just printed. Without that step you wouldn't have to copy the files every time you wanted to print, but it does guarantee that you will retrieve and print every file on the disk in sequence.

The only thing I could think of was to replace lines 2 and 3 with /fr{right}^ in the second file, /fr{right}{right}^ in the third file, and so on, but that may be more trouble than it's worth.

Share your latest spreadsheet discovery through *PC*'s Spreadsheet Clinic. We'll pay you $50 for anything we print, plus an extra $25 if you submit it on a disk. If you send a disk, please include a printout of your submission.

Mail your contributions to Spreadsheet Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016.

Figure 8: A screen shot of the file called 123PRINT .PRN (lower part of screen).

User-to-User

PC readers use this forum to help one another by passing along their questions, solutions, comments, and complaints.

DOS Phone Utility

The DIAL.BAT batch file in Figure 1 is a simple telephone dialer—with its own built-in directory—that uses features of the Hayes Smartmodem and the output redirection capabilities of DOS. DIAL.BAT will automatically dial the phone (with a 1200 baud modem), disconnect the modem, and allow you to continue the call. In addition, it lets you set up an extensive dialing directory by expanding the conditional tests for names within the program. You'll need to have the DOS program MODE.COM on the same diskette as the dialer program or in a directory specified by PATH if you have a hard disk.

To use the program, just type:

    DIAL number

(then hit Enter) where "number" is either the telephone number you wish to dial or the name of someone in the program's directory. Lift the handset, listen to the speaker in the modem to determine when the dialing is done, and then press any key to disconnect the modem and reconnect the handset. Complete your call as usual.

MODE ensures that the right COM port is set to the proper baud rate. If you're using COM2 or a different baud rate, change the values in the program accordingly. MODE usually prints a message to the screen; DIAL.BAT gets rid of this by redirecting it to the NUL device. The "echo." line helps format the display; if you prefer a blank line, substitute spaces for the period. Just be sure that there are at least two spaces after the ECHO command.

I have successfully used this program with the Hayes 1200 and 1200B Smartmodems. I expect that other modems that emulate Hayes commands will work with DIAL.BAT. DIAL.BAT could also be configured to transmit other autodialer commands for use with non-Hayes-compatible

modems. When using other modems, be sure the RS-232-C lines CTS (clear to send) and DSR (data set ready) from the modem are on, or else a DOS error will result. I was unable to use DIAL.BAT with a RIXON R212A Intelligent Modem because of this. Although RIXON modem options can be set for DSR and CTS on, the lines are apparently disabled until the "wake-up" signal to the modem is sent. DOS, however, aborts the transmission to the modem before it sends any characters at all since the modem does not appear to be ready.

R. Frazier
Petaluma, California

While this obviously doesn't do everything a full-blown communications program can, it stores names and numbers and dials them adroitly. This is a spiffy use of some of the smarter features of DOS and Hayes modems.

Better Stripper

Since I believe that negative numbers occur just as often as positive numbers, I believe that "My Favorite Stripper" (*PC Magazine*, Volume 4 Number 5) could use a little enhancement.

First, add the little-used SGN() function, which returns a -1 if the number is negative and a +1 if the number is positive (see Figure 2). This will work for all positive and negative numbers, but not zero. However, we can check to see if the number is zero, within the formula, by using another trick (see Figure 3). If Z=0, that part of the formula evaluates to -1, which will in turn remove the leading space.

Kevin King
Sheridan, Wyoming

The (Z=0) trick is terrific, and variations of it can be used elsewhere as elegant tests.

CIRCLE 186 ON READER SERVICE CARD

FIND Unquoter

I'm a frequent user of the DOS FIND filter and grew tired of having to enclose each string I was searching for inside quotation marks. I figured out how to fix FIND.EXE so that quotes are not necessary (see Figure

4). The drawback is that this new version of FIND can't search for strings containing spaces. I named this utility after the UNIX command FGREP.

Walter Bright
Kirkland, Washington

```
echo off
mode coml:1200 >nul
if %l == TOM goto tom
if %l == dick goto tom
if %l == DICK goto dick
if %l == dick goto dick
if %l == HARRY goto harry
if %l == harry goto harry
echo ATDT%l ;>coml:
goto exit
:tom
echo ATDT111-1111; >coml:
goto exit
:dick
echo ATDT222-2222; >coml:
goto exit
:harry
echo ATDT9-333-3333; >coml:
:exit
echo .
echo   Pick up the handset first then, after the dialing is complete,
echo   press any key to disconnect the modem.
echo .
pause
echo ATH >coml:
```

Figure 1: DIAL.BAT batch file to dial with a 1200-baud modem. Be sure MODE.COM is on your disk or PATH to it. Substitute your own names and numbers for TOM, DICK, and HARRY (as well as 111-1111, 222-2222, and 9-333-3333).

```
DEF FNST$(Z)=RIGHT$(STR$(Z),LEN(STR$(Z))-SGN(Z))
```

Figure 2: Stripper enhancement that works for negative numbers.

```
DEF FNST$(Z)=RIGHT$(STR$(Z),LEN(STR$(Z))-SGN(Z)+(Z=0))
```

Figure 3: Best stripper—this works with both negatives and zero.

```
A>copy find.exe fgrep
    1 File(s) copied
A>debug fgrep
-e 3cc
xxxx:03CC   75.4e    8A.90
-e 3e9
xxxx:03E9   22.20
-e 3ec
xxxx:03EC   AC.90    3C.90    22.90    74.90
xxxx:03F0   0F.90    4E.90
-w
Writing 18DB bytes
-q
A>ren fgrep fgrep.exe
```

Figure 4: Instructions for changing DOS 3.0 FIND.EXE so it doesn't require that you put quotation marks around strings for which you want to search. Type in everything underlined and hit the Enter key at the end of each line. Ignore the xxxx: parts; the hex numbers that appear here vary from system to system.

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The drawback you mentioned isn't a problem, since you can always use the wildcard FIND filter when searching for multiple words separated by spaces. Another way to eliminate the need for quotes is to create a batch file, F.BAT, containing the line:

```
FIND "%1" %2
```

To find every occurrence of DIR in COMMAND.COM for instance, just type:

```
F DIR COMMAND.COM
```

Big Letters

Users with color systems can produce unusually large letters in text mode in 16 colors by sending a value of 12 out to port 984. The program BIGLET.BAS (see Figure 5) OUTs the proper value and controls the location of these large characters. This mode is not supported by IBM: the screen will flicker, and there are problems both in the text offset and in character overlap.

```
100 ' BIGLET.BAS -- by Brad Thurber
110 SCREEN 0:WIDTH 80:KEY OFF:CLS
120 OUT 984,12
130 LOCATE 1,1:PRINT "Hit ESC to end"
140 FOR Y=2 TO 15
150 LOCATE Y,1
160 FOR X=1 TO 30
170 COLOR RND*13+2
180 A$="":WHILE A$="":A$=INKEY$:WEND
190 IF A$=CHR$(27) THEN SYSTEM
200 PRINT A$;
210 NEXT:NEXT
```

Figure 5: *BIGLET.BAS program to produce unusually large letters on RGB monitors.*

I've tried this on the standard IBM RGB monitor, but not on composite screens.

Brad E. Thurber
Fort Wayne, Indiana

While this isn't really all that useful, it does produce a flickery, attention-getting image. We added an escape route to the program; hitting Esc drops you out of the program and into DOS. The 6845 chip on both the color and mono boards can do far more tricks than IBM uses.

Hex Strings Restrung

In response to the User-to-User Hex Strings tip (PC Magazine, Volume 4 Num-

```
A>ren sample.exe sample.exx
A>debug sample.exx
-cx
CX 0880
:
-e 100 0880 'A CHARACTER STRING'
xxxx:0803
-e 0803 "A DIFFERENT STRING"
-w
Writing 0880 bytes
-q
A>ren sample.exx sample.exe
```

Figure 8: General instructions for replacing text with new character strings. This example also demonstrates that you must change the name of an .EXE file you're revising since DEBUG won't write to an .EXE file. Rather than simply rename the .EXE file, it's better to copy the old .EXE file to one with a non-.EXE extension. If you're dealing with a non-.EXE file, you can skip the first and last steps above. Type in everything underlined and hit the Enter key at the end of every line. Ignore the xxxx; the hex numbers that appear there will vary from system to system. And make sure the new string is the same length as the one you're replacing; pad it out with spaces if it's too short.

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CIRCLE 196 ON READER SERVICE CARD

PC Tutor

This special PC Tutor is the first of two explaining binary, hexadecimal, and decimal notation.

I frequently get questions about number representation in general and about the handling of floating-point numbers by BASIC in particular. Since this is such a complex topic, I've decided to devote two entire columns to it. Let's begin by describing the different ways in which numbers are written.

Number Systems

One of the first things newcomers notice when they start reading computer magazines is the frequency with which they encounter hexadecimal (base 16) numbers. This often causes confusion—even anger—at what is perceived as unnecessary jargon. In fact, however, there are very sound reasons for using hexadecimal notation in preference to decimal (base 10) notation. Even binary (base 2) notation should be used in certain circumstances. Figure 1 shows both (a) the symbols used to denote different digits and (b) several examples of numeric hexadecimal (base 16) numbers commonly used in computer writing and programming.

One thing clearly evident from Figure 1 is the "obvious" truth that the more different symbols you have available to represent a number, the shorter the number can be written. FFFF (hex), 65535 (decimal), 177777 (octal), and 1111111111111111 (binary) are all the same number, but the first representation takes 4 places and the last takes 16 places. Humans have trouble keeping track of long strings of numbers (ensuring that 16 and not 15 successive 1s get printed in this paragraph is a proofreader's nightmare, for example), but for a machine this system is much easier than keeping track of a lot of differently valued symbols. Two is the minimum number of symbols needed to represent 1 and not-1 (i.e, 0), and, as presumably every reader of this magazine already knows, all machine code consists of nothing but strings of binary (base 2) numbers.

As a concession to human weakness, however, references to "computer numbers" are conventionally translated (even by a utility like DEBUG, which works directly on machine code) into hexadecimal

(a)

Name	Base	Numeral Set
hexadecimal	16	0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
decimal	10	0,1,2,3,4,5,6,7,8,9
octal	8	0,1,2,3,4,5,6,7
binary	2	0,1

(b)

hex	decimal	octal	binary
1	1	1	1
8	8	10	1000
A	10	12	1010
F	15	17	1111
10	16	20	10000
3E8	1000	1750	1111101000
400	1024(1K)	2000	10000000000
FFFF	65535	177777	1111111111111111

Figure 1: *The four common number bases, with examples.*

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form. Each hex digit is the equivalent of four binary digits (bits), as shown below:

hex	binary	hex	binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

Two hex digits then represent 1 byte of information, and from the table above you can always translate down into binary to see which bits are 1s and which are 0s.

Of course, need not have been defined as containing 8 bits. Earlier in computer history, grouping things in terms of the possible values of 3 bits at a time was popular, giving rise to octal (base 8) notation. (That's the last time I'll mention octal.) But the "powers of x" idea is as strong in computer design (where x is 2) as in "human" design (where x is 10), because it is the most efficient way to handle place value. (If we'd been born with eight fingers on each hand, the same smart Arab who gave us 10 arithmetic symbols would have squiggled his pen a few more times and we'd have one-place "mathematical" symbols for the numbers from 10 to 15. And we'd all think more like our computers.) Mathematically, if a number is represented as a sequence of digits:

$$d_n \ldots d_3 d_2 d_1 d_0 \text{ in a number base } b$$

then the value of that number is

$$d*b^n + \ldots d*b^3 + d*b^2 + d*b^1 + d*b^0$$

A few examples of working with hex in terms of the PC's 8088 microprocessor will show how much clearer hex makes things than does decimal.

The 8088 has 20 address lines. Each line can be a 0 or 1 (this is digital; ones are +5 volts and zeros are 0 volts). Thus, the 8088 can address at most

```
1111 1111 1111 1111 1111 binary
(or FFFFF hex or 1,048,575 decimal)
```

characters (bytes). We generally say that the 8088 has a 1-megabyte memory capacity. The exact number in base 10 (1,048,575) is meaningless, but it is very meaningful in either binary or hexadecimal. Both are much closer to the way the computer thinks. [Note: for visual clarity

we have inserted spaces after every four binary digits, such as commas are conventionally used with groups of three decimal digits. If you ever type binary numbers into a program, however, you must be careful not to use such spaces, because the computer will not ignore them.—Ed.]

Thus, if you work in hexadecimal, just by knowing that the 8088 has 20 address lines you immediately know its directly addressable memory capacity. Similarly, if you tell me that an integer is stored at 0305hex, I know immediately that (1) the machine uses 16-bit addresses, and (2) when the integer is accessed, lines 9, 8, 2, 0 should be high; the rest should be low. This is because 0305 hex = 0000 0011 0000 0101 binary. (Line numbering begins with the right-most digit.)

Consider next the way the 8088 computes the addresses of objects. It does this by combining the contents of two registers (normally, DS and DX), each of which contains a 16-bit quantity (a hexadecimal digits). If we refer to DS:DX, for example, the actual address in decimal would be calculated via:

effective address = DS*16 + DX

This looks a bit strange to me in decimal notation, and it is not easy to calculate—try it, assuming DS is 4096 and DX is 256, for example. If we switch to hexadecimal, however, the problem becomes

effective address = DS*10 + DX

which looks a lot simpler. In fact, it says: put a 0 at the end of the number in DS and add it to that in DX. Now, using the same numbers as above (in hex), we have

```
DS          1000 Hex
DX           100 Hex
DS*10      10000 = DS*10
DS*10+DX   10100 = DS*10 + DX
```

Thus, the effective address is 10100 hex. If you did it in decimal, you'd come out with 65792.

Conclusion: When referring to the IBM PC, it often makes much more sense to state computer references in hexadecimal or binary.

So much for written language, now let's see why computer languages use binary primarily for calculations. The internal representation of a number is the way a

computer encodes it into its internal memory (registers). There is actually no intrinsic reason that a computer or computer language could not use decimal notation internally, but there are good mathematical reasons why it usually doesn't.

Hardware and Accuracy

To understand why computer languages use binary arithmetic internally, we should start by understanding why the computer chips have small registers. Why does the 8088 on the IBM PC have 16-bit registers rather than 100-bit registers, which would produce greater accuracy?

Today's digital logic requires one line (that is, an electrical path) for each binary digit (bit) in a number. This is because of recognizing only two voltage levels: low (0) and high (1). For each line on a microprocessor chip, however, there are probably 5 to 10 more supporting chips on the computer motherboard for buffering and control. Thus, the fewer outside lines a microprocessor chip (a CPU) has, the cheaper it is to design and build both the chip and its support. The 8088 is relatively cheap, since it provides only 8 data lines to the outside world, even though internally it "thinks" with 16 data lines. (In the jargon, the 8088 has an 8-bit external data bus and a 16-bit internal data bus). This means that sometimes a numeric transfer requires two successive accesses to memory: one for the low 8 bits and one for the high 8 bits.

The 80286 used by the PC AT on the other hand, has a full 16-bit data bus, so programs with a lot of memory-based arithmetic automatically run more quickly, even ignoring such other speedups as a higher clock rate. The 8086 (used on the AT&T 6300 and the Compaq Plus, among others) also has a 16-bit data bus. Though the 8086 was available when the PC was developed, IBM opted for the 8088 because of the dollar savings resulting from using 8 rather than 16 data lines.

Thus, to reduce cost in computer designs, the hardware people use as few data bits as possible, both internally and externally. Microcomputers are usually 8- or 16-bit designs, while mainframes are typically in the 60- to 80-bit range.

While the hardware designers have an interest in reducing the number of bits in a register, the language writers, on the other

side, want to minimize the errors that result from arithmetic roundoff and overflow. One way they do this is by using binary arithmetic internally. Let's compare arithmetic strength—that is, the accuracy and range—of an 8088 language that represents numbers in binary form internally, (which we read as hexadecimal) with one that uses decimal internally.

A single hexadecimal digit has a maximum value of 15 decimal (1111 binary). Hence it requires 4 bits in order to represent the full complement of hexadecimal digits. A decimal digit also requires 4 bits, however. (Try to represent 8 or 9 with 3 bits, if you're skeptical.) An 8088 register holds 16 bits of information. Thus, the 8088 can manipulate either (but no more than) 4 hex digits or 4 decimal digits (16 bits total). Now consider a number, x, that equals 1237 decimal (4d5 in hex). A decimal language stores x as

$$\overset{1}{000}\overset{2}{1}\;\overset{3}{0010}\;\overset{7}{0011}\;0111$$

A binary language stores x as

$$\overset{0}{0000}\overset{4}{0100}\;\overset{d}{1101}\;\overset{5}{0101}\;(hex)$$

In this example, the only difference lies in the encoding method, but a hint is given by the fact that the binary/hex version needed only three digits to represent the decimal quantity 1237. If you now return to the last example shown in Figure 1, you'll see that since the 8088 has 16-bit registers it can easily manipulate any number up to FFFF (65535 decimal) by using hexadecimal encoding. On the other hand, if the 8088 uses decimal encoding it can only easily manipulate numbers up to 9999. This means that by thinking internally in hexadecimal (or binary), a language running on the PC can increase the usable range of its arithmetic by 6.5 times, in comparison with decimal. Indeed, the disparity gets even larger with bigger word sizes. A machine with 32-bit internal arithmetic increases its arithmetic range by 43:1 if it uses hex, not decimal, internal representation.

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016. ■

A Bridge to Better Graphics:
The Math Utilities

Designed to display scientific formulas, plot planar curves, and represent three-dimensional surfaces, The Math Utilities create high-quality graphics on an extra-high-resolution printer.

Graphics programs don't like me because I know too much mathematics. For line graphs they want pairs of numbers. I respond too generously by presenting them, in effect, with an infinite number of pairs by asking for plots of such equations as the parabola $y = x^2$.

For any value of x you please, the corresponding y value is well defined: just multiply x by itself. Since graphics programs tend to be business-oriented, they can't deal with this kind of information. Instead, they tediously insist on being told that $y = 0$ when $x = 0$, $y = 1$ when $x = 1$, $y = 4$ when $x = 2$, and so on.

Unless you enter a large number of pairs for such functions, the resulting graph can look pretty sad, its smooth curve broken into a series of straight-line segments. Scientists pay a high price for abandoning the simple definition by

equation in favor of pairs of points. To display scientific graphs, they need a package specifically designed for such curves.

Easier said than done. Scientific graphics software usually means one thing: curve-fitting. These programs know what curves you want to draw, but they expect to have to guess the correct formula. Once you provide them with enough pairs of data points, they give you a graph and a "best fit" equation. Such programs seem taken aback when you already have the formula and merely want them to display it.

Mark Bridger, of Bridge Software, stepped into the breach when he wrote his *Math Utilities*. CURVES plots planar curves, SURF, surfaces in three-dimensional space, and DIFFS, planar flowlines determined by differential equa-

tions. (I will not review DIFFS here because it is much more specialized.) A professor of mathematics at Northeastern University, Bridger understands that not all graphics consist solely of pie charts, bar charts, and scientific curve-fitting. He designed *The Math Utilities* to display known functions for educational or illustrative purposes.

The Math Utilities understand and accept in formulas the functions ABS, SIN, COS, ARCTAN, EXP, LN, SQRT, S, C, and AT, where S and C are the sine and cosine functions whose arguments are multiplied by 2π and AT is the arctangent function divided by 2π. Bridger recently added the function ROOTn(), where n is a positive integer; for example, ROOT3(x) is the cube root of x.

High-Quality Graphics

CURVES produces high-quality output on an IBM Graphics printer or an Epson with GrafTrax. The quality is so high that I recently used CURVES 87.5, the 8087 version of CURVES, to produce camera-ready figures for a student solutions manual I wrote for a calculus book.

On a PC with 256K of RAM, the graphics program resides in 128K of memory while the Bridge Software Printerpack option uses the other 128K to draw an extra-high-resolution version of the graph. The IBM or Epson printers can draw a figure whose resolution is 1,600 by 640, far exceeding the 640 by 200 resolution of the IBM Color/Graphics board.

Illustration: Greg Ragland

The Printerpack option relies heavily on the 8087 math coprocessor. If your PC does not have the coprocessor, the Printerpack feature will still work, but drawing the graph can take hours.

All three Bridge programs are menu-driven, and the user interface is functional and straightforward. The Overlay option in the CURVES menu leads to a submenu that controls the Printerpack feature and the superposition of several curves on the same graph.

Figure 1: *An example of SURF's output.*

CURVES

CURVES is extremely flexible, permitting equations to be entered in rectangular, polar, or vector (parametric) form. In addition, two curves can be plotted simultaneously even without the Overlay option, which permits many more. Scales are completely under the user's control, as are coordinate ranges. Although the first plot is always presented on an axis system whose origin is centered on the screen, selection rectangles of different sizes can be used to "cut" a portion of the graph for enlargement.

You may choose to have CURVES display the coordinates of the upper lefthand corner of the selection rectangle as you move it about the graph. This is an extremely convenient way to read off coordinates on the displayed curve. Furthermore, if two curves are displayed, their points of intersection can be determined easily. If necessary, successive selections and enlargements of part of the figure will zero in on the point of interest.

Bridger recommends against pushing this process too far, however, because you may propagate errors that can invalidate your result. If you have an 8087, 15 levels of enlargement are feasible; without the 8087, no more than 10 enlargements should be attempted. Bridger

notes that it is actually possible to lock up your PC by zooming in too far. If that happens you must reboot the computer.

CURVES permits you to save displays to disk as the file PICTURE.DAT. Other names are not permitted, one of the few unsatisfactory features of the Bridge software. Saving multiple figures requires exiting to DOS and changing the filename PICTURE.DAT to avoid overwriting it with the next figure. Furthermore, only the file PICTURE.DAT may be retrieved for display, so filenames must be changed back individually for recovery. I hope that future versions will allow arbitrary filenames.

SURF

SURF is even more fun to use than CURVES. Once again, the 8087 chip is needed to use the Printerpack option effectively. Figure 1 shows an example of SURF's output with the Printerpack.

SURF bristles with an incredible number of options. It produces graphs by sitting on the x-axis of a three-dimensional coordinate system and sketching what it sees on an interposed plane—rather like marking on a glass panel you hold in front of you. How close you hold the glass determines how big a figure you trace. SURF permits you to decide its viewpoint (which doesn't have to be on the x-axis) and the location of the "viewplane" (corresponding to your glass pane). You can also rotate and stretch the graph and add cross-hatching.

Despite its wealth of features, SURF manages to be easy to use. It happily chooses scales for you under the Autograph option. I found it best to use Auto-graph first and then fiddle with the results. Sometimes you need to nudge the figure with a slight rotation to get the hidden-line algorithm to work properly. Bridger details some of the problems and their solutions.

Documentation

The documentation for the *Math Utilities* was generated on a dot matrix printer with effective use of italic, bold, and wide fonts. The text is straightforward and a bit unusual in its approach. After detailing the features contained in the

menus, Bridger goes on to present a workshop session for each of his programs. These sessions are extremely valuable and serve as tutorials. The three manuals (one each for CURVES, SURF, and DIFFS) do not contain indexes, but since the longest is only 15 pages, the absence is not keenly felt. The illustrations are helpful and were clearly produced by the software itself.

More Uniformity Needed

The *Math Utilities* are available separately or as a set. Despite their similarities, the programs have curious differences that are occasionally annoying. In CURVES you hit the Esc key twice to invoke the menu. In SURF the Enter key is used for the same purpose. In CURVES q means "quit," while in SURF the same option means "quit and draw," that is, quit the menu, but not the program. More uniformity in the user interface would be nice.

Am I satisfied with the *Math Utilities?* Of course not; there are always more options to want: axis drawing, nonrectangular domains, closed surfaces in SURF, a picture editor for labeling Printerpack images, and faster print times.

Price/Performance Ratio

Am I delighted with *The Math Utilities?* Absolutely. They have been a delight to use, and the results have been immensely satisfying. The price/performance ratio for this package is stupendous. Nothing comparable is available this side of the $350 program from EnerGraphics (see "Graphics that Dress Up Success," *PC*, Volume 4 Number 1). The software is not copy protected, another thing I appreciate and, in fact, insist on. Anyone who rips off these bargain-priced programs deserves to have his PC busted to 16K.

Now that my student calculus manual is finished, my publisher wants one for instructors. Bridge software will again be my primary graphics tool. I just can't imagine being without it. ∎

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Confessions of a PTA Fund–Raiser

Here's one PC owner's advice on how you can use your PC to rake in money at your children's fund-raising extravaganzas. Interactive BASIC programs that challenge and intrigue can make you the star of the show.

G one are the days of baking cookies and trying to pawn off raffle tickets on friends and relatives. Now, my PC makes brownie points at my children's fund-raising events.

Long after all the face-painting, handicraft, and baked goods booths play out, my computer-ade stand continues to attract long lines of pint-sized, computer-hungry kids. And while my trusty PC rakes in the dough, it also conducts some computer literacy work. Skeptical parents slowly begin to smile when they discover their children are not spending money to chase a goofy "pill" around a maze but are experimenting with a customized BASIC program. Your PC can help make the parent-school connection more efficient in various ways. Word processing, database, and mail merge programs all make the myriad of rosters,

lists, newsletters, and fund-raising events—which make up the normal parental curriculum—a breeze. But, even though all of this behind-the-scenes computer power will certainly be appreciated by your local PTA, computer activities that have dramatic flair raise lots of money and are obviously much more fun to do.

Letters to Santa

At nursery school Christmas fairs, my PC woos the uninitiated with a short but sweet interactive program that lets kids type personalized letters to Santa.

As each child operates the keyboard, the computer asks, "What's your name?" Delighted with the machine's interest, the child carefully hunts and pecks an answer. "How old are you?" asks the computer. Again the child responds. "Have you been good this

year?" asks the computer. Ah, the questions are getting tougher. "What would you like for Christmas?" was the computer's ultimate query.

After a child answers the series of questions, the program prints a personalized letter to Santa using big block letters. Rows of tiny Christmas trees made from X's and O's dot the border of the letter. And, in keeping with the spirit of the occasion, the PC offers a rousing rendition of *Jingle Bells* while the printer churns out the letter. I then mount the printouts on paper so that Mom and Dad can save it as a reminder of their child's wish list.

A Mother's Day Sequel

A Mother's Day version of the computerized letter fund-raiser also wins rave reviews. Mommy-adoring children feverishly type the answers to computer-generated questions such as "What's your Mother's favorite color?" "What's her hair color?" "What's her favorite place to visit?" and "What's your favorite number?" The child presses the Return key to start the customized Mother's Day card rolling. A large heart and arrow surround the entire assemblage and its decorative borders tell who the card was from and to.

One 5-year-old girl input the following Mother's Day:

On Mother's Day your BROWN hair
Smells like TULIPS on a sunny day!
I love you 30 times
Don't ever go far away
I'd like to buy you a new PURPLE coat,

Or take you to GRANNY'S HOUSE on a golden boat.

But since all I've got is this dollar bill, I'll make you a card and love you still.

Interesting Dynamics

These two simple programs generate unbelievable enthusiasm. In fact, some interesting dynamics transpired when I set up my computer-ade stand at a few school fund-raisers. Older children read to and prodded younger ones along. Shy children put forth a shaky little pointer finger and asked me to help them find the keys. Other more explorative children pushed my helping hand away and embarked on their own painstaking search for the proper keys. Kids began to predict the print spooler magic and summon the recipient of the upcoming printout long before the child's name emerged on the page.

Groups of kids began singing along with the computer, and kids of all ages returned to the line a second time, begging to create yet another computerized masterpiece. Older kids questioned the elements of programming. "What would happen if we typed a silly answer?" they asked. "I bet I know how you made those Christmas trees, like this," exclaimed one youngster, as he excitedly began to draw characters on a scrap of

> My two simple programs generated unbelievable enthusiasm when I set up my computer-ade stand at school fund-raisers.

paper. The other fund-raising booths had their share of attention, but my computer-ade stand attracted a dedicated and steady following.

Anticipating the "What Ifs"

When designing these games, I tried to anticipate the spectrum of possible responses. The questions I invented were simple and nonsexist, and all of them could be answered in short phrases. In addition, the program was designed to challenge children of all ages. The

graphics and music captivated the children, and the interactive session was long enough to be meaningful, but short enough to keep the crowds moving. The printout was an attractive take-home re-

> The interactive session was long enough to be meaningful, but short enough to keep the crowds moving.

minder of the child's effort.

At the events, I always hide all wires, keep the CapsLocks key on throughout the day, and try to direct an orderly flow of juvenile traffic. I enforce proper rules of computer etiquette, including no drinking, eating, or painted-up hands at the keyboard, and I do not allow children to pull from the printer without my blessing. I learned to put a decorative covering over the disk drives in order to eliminate the temptation of seeing what lies behind the computer's trap doors.

Success Stories
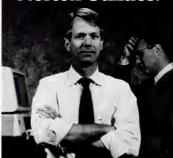
Both of my computerized fund-raising ventures have been financial and psychological successes and required only an infinitesimal knowledge of BASIC to design. The PC always emerges as Mr. Personality—adorable, entertaining, lovable, and cute. Because of the nature of the events and the simplicity of the programs, very few would believe that my PC compiles C programs at home.

Conclusion

With apologies to Henny Youngman, I ask you, take my program, please. Both the Dear Santa and the Mother's Day programs are available on *PC*'s Interactive Reader Service at (212) 696-0360. You can impart your own customized permutations and combinations, change the music, change the graphics, and change my poor attempt at poetry. These programs are simple and easily modified. Happy fundraising!

Robin Raskin is a frequent contributor to several computer publications, including PC.

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Continuing Medical Education On-Line

MGH-CME, a service of GTE's MINET database, offers an alternative to inconveniently scheduled CME courses. And you can earn AMA credits from Harvard via MGH-CME's interactive, self-paced courses.

A new medical diagnostic or therapeutic technique is much easier to learn if you use a computer simulation package prior to experimenting on a patient. However, if you're an individual practitioner, it's rather wasteful and costly for you to purchase your own simulation package for every disease you want to research. After the third or fourth time through the same simulation, you will know all the correct answers and derive no further benefits.

GTE's on-line medical database, MINET, offers a good solution to this problem with its MGH-CME service. I believe this section is more useful than any other part of the database (see "Find It with MINET," *PC*, Volume 4 Number 2, for a general description of MINET's other services).

Interactive Courses

MGH-CME consists of a collection of interactive, self-paced medical courses that are developed and maintained by the Massachusetts General Hospital, the major teaching hospital for Harvard Medical School.

The system covers 24 subjects, including anticoagulants, arrhythmias, basic life support, digitalis, arterial blood gases, cardiopulmonary resuscitation, neonate hepatitis prophylaxis, and hypertension.

You can access courses either through a menu or with a three-letter subject code. Each course consists of a case simulation that's based on one specific area of medicine. When you've finished one simulation, you can choose to go on to an-

other in the same field, switch specialty areas, or quit the system.

But MGH-CME does not give you the same case simulation each time you select a given course. The system continually generates new scenarios for each subject area and keeps tabs on how many times you have gone through a given subject. It also augments the difficulty of the case each time you reaccess the same subject area.

In addition, Massachusetts General Hospital continuously updates the course information to keep up with changing medical thought and practice.

Various Approaches

MGH-CME uses four approaches—multiple choice, free text (essay), tutorial, and vocabulary—to teach the material. Although you choose the subject, the

system chooses the method of presentation.

The multiple choice question (MCQ) course presents a brief description of a clinical situation and asks you to choose which of several steps is appropriate. If you pick the wrong answer, the system explains why it's wrong and gives you another chance to select the correct response.

The free-text courses ask you for essay-type responses, and then the program searches your input for certain keywords to determine the correctness of your answer. For example, the course that helps you practice how much of the drug coumadin to administer to a patient to maintain a therapeutic PT (a blood test) simulates the time lag between when you administer the coumadin and when the drug takes effect. It then shows the changes in the clinical status of the patient to which you must respond. Thus, it forces you to deal with metabolic and drug-drug interactions.

A Lecture Format

The tutorial courses present information in a lecture format that is interspersed with multiple-choice and free-text questions. The course determines your level of comprehension by your answers. Every tutorial course has many sections and a table of contents, so that you can choose a given section or group of sections without going through all the subjects covered by the course. Or you can follow the program's suggestions, which are based on your answers to test questions, as to what sections of the tutorial are appropriate to your level of expertise. If you leave the system and then log back on, the system saves your place so you can begin where you left off.

The vocabulary-item type of courses initially present a brief case history. At the prompt, you can ask questions, perform a physical exam, order laboratory studies, or administer therapy.

The problem with the vocabulary section is that you must look through a user manual to find a number that corresponds to the phrase you want to enter. Each course has its own different set of phrases and numbers, so it almost takes a juggling act to keep going. This, however, was the only weak point I found.

That aside, the system works beautifully. Like disk-based simulations, such as those offered by CME Incorporated, the patient's progress is dependent on the accuracy of your therapy (see "New Approaches to Practicing Medicine," *PC*, Volume 4 Number 11, for a review of CME simulation software). The program returns lab values with a simulated time delay and periodically prompts you for a diagnosis.

Special Options

You may request two special sets of options at any point within the vocabu-

lary courses. The "rules" option explains medical or clinical rules as they arise during the course. While you are working up a patient, the system monitors your actions. If you neglect something important in the scenario, the system will intercede to remind you of it. For example, if you're dealing with a febrile, unconscious patient, you might receive the following message:

YOUR ATTENDING PHYSICIAN SUGGESTS THAT YOU PERFORM A LUMBAR PUNCTURE [RULE 9].

The rules option allows you to ask why the rule was invoked, the purpose and definition of the rule, or what action the system suggests you take. In the preceding example, if you enter PURPOSE, the program responds:

A LUMBAR PUNCTURE IS A KEY
ITEM IN THE WORK UP OF A
PATIENT WHO IS SUSPECTED OF
HAVING MENINGITIS.

The second set of options, called the "consultant" options, is even more useful. I only wish I could use the consultant options, which are divided into six parts, independently of the CME program to help in my daily clinical work.

The "item info" option provides information about the numbered items in the course book. This information constitutes what the system's developers call a mini textbook about the item.

The "best tests" option lists the available tests that are likely to be of value given the information you've already obtained from the system.

The "consider" option allows you to select a possible diagnosis and then lists the tests most likely to confirm or refute that diagnosis.

The "discriminate" option allows you to choose two possible diagnoses and will then list the best test to distinguish between them.

The "leading diagnosis" option allows you to display the most likely diagnosis based on the information you've already collected.

The "teaching" option discusses the general approach to diagnosis in the specialty field that you are currently seeing.

I went through the anemia, abdominal pain, arterial blood gas, and cardiopulmonary resuscitation sections four times each. I didn't experience the same case or even two similar cases twice. Each section was realistic, well planned, and informative. I truly learned from each case I went through and had fun doing it.

AMA Credits

To top it all off, you can receive several Category 1 CME credits, sponsored by the Harvard Medical School Department of Continuing Education, for completing each of these scenarios. However, these are American Medical Association cred-

its. It's $60 per year for AMA members and $100 per year for non-AMA members. You just register when you log on to the service.

The only real complaint that I might raise about these programs is the cost. Even though GTE has reduced the monthly rates to a $20 minimum, the hourly fees are substantial. Using the MGH-CME service costs plus the base Telenet charge and local phone costs, and you've got quite a bill. Then there's an extra charge if you would like CME credit from Harvard. In fact, all CME courses are expensive, especially when you have to leave your practice to attend them. However, in this case, the high quality of the product allows me to overlook its high price. ■

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Forecasting Tools for The Business Manager

Now you can do your own business forecasting on a PC. New interactive programs save time, improve accuracy, reveal hidden trends, and introduce some effective new techniques.

U ntil recently, business forecasting software was custom-programmed for mainframes and run by a technical staff. The job of computer-aided forecasting was unwieldy and too slow for managers facing typical I-need-it-yesterday pressures. But times have changed. New interactive programs transfer forecasting techniques to the PC, making the process quick and accessible to business people themselves.

These forecasting programs model historical data in one of two ways. The first is linear regression, which computes the average relationship between a dependent variable, such as sales, and one or more independent variables, such as advertising, GNP, price, and so forth. The second approach is extrapolation, or time series forecasting.

A time series is a set of data collected at regular intervals—for example, a list of the monthly sales for a product. Time series forecasting is easier than regression because independent variables are not used. Forecasting is done by first identifying patterns such as seasonal cycles or trends in the history of the data and then projecting them into the future.

Time series forecasting typically starts with a statistical start to determine whether a seasonal cycle exists and computes it if it does. Next the program offers you several choices for the rate of growth (trend) in the forecasts. Common options are no trend at all, a straight-line trend, or an exponential trend—one in which the growth rate increases continuously. Finally, the program asks how many forecasts you want to make.

Forecasts for these options are usually presented as graphs showing how the forecast compares to historical data. A program should also give you confidence intervals—statistical boundaries that may be exceeded only a specified percentage of the time. For example, the forecast for next month may be 100 units, with a 95 percent confidence interval of 20 units. This means roughly that there is a 95 percent chance that sales will range from 80 to 120.

Factors Affecting Accuracy

Whether your forecasts are made by regression or time series models, accuracy depends on several factors. One is randomness, or "noise," in the data, which, since it cannot be predicted, limits its accuracy. If 10 percent of each data point is due to randomness, an average error of 10 percent is the best you can expect. Another factor is the forecast horizon, or how far in the future you are trying to forecast. Errors become larger as the horizon increases.

"Scrubbing" (adjusting the data to remove the effects of one-time events like sales promotions or unusual weather) also has a tremendous impact; so do changes in the number of trading days from month to month. It's necessary to compensate for these factors to avoid distortion.

Judgment Calls

Although software manuals rarely admit it, there are many situations in which human judgment is the only realistic approach to forecasting. One occurs when not much data is available for modeling—forecasting sales for a new product, for example. Or the marketing

environment may change drastically, making historical data irrelevant.

When you have adequate data, model-based forecasts are preferable to human judgment. Why? Modeling saves time, especially if you have a lot of forecasts to make. It may also reveal features in the data that could be overlooked. For example, using a model adjusted for seasonality can reveal trends concealed by seasonal patterns. Modeling also gives you a benchmark for evaluating judgmental forecasts.

In choosing a forecasting program, look for three key features. First, you need good graphics to help you decide which model to use and to present the forecasts. Second, your data probably comes from existing spreadsheets or databases, so make sure that the forecasting program can use these files. Third, look for a program that automatically adjusts data for seasonality. Without auto-

matic seasonal adjustment—you are in for a lot of time-consuming work before you can begin forecasting.

If you need background, *Forecasting Methods for Management* by Wheelwright and Makridakis (John Wiley & Sons, New York; 4th edition, 1985; ISBN 0471-816-876) makes good reading because it assumes no prior knowledge of statistics. It also has many examples that can be repeated on the PC.

1,2,3 FORECAST!

There are several programs aimed at the beginning forecaster. If you use Lotus's *1-2-3*, your best bet is a little gem called *1,2,3 FORECAST!* Consisting of seven templates, it offers seasonal adjustment, regression with one or two independent variables, and time series forecasting. By staying in *1-2-3*, you can avoid having to export your data files and learn the command structure of another

program. Another big advantage is that you can customize the templates.

1,2,3 FORECAST! comes with a good set of tutorial exercises in forecasting airline revenue passenger-miles. Just about everything in *1,2,3 FORECAST!* is menu-driven. Most of the menus are three or four levels deep but include the ability to back up to the previous level if you make a mistake. The templates contain a number of slick error-trapping routines that beep and present an error message on the control panel. These messages are tailored to whatever template you are using. When an error message occurs, all you have to do is press the Enter key, which backs up the program and lets you try again.

One problem with *1,2,3 FORECAST!* is that data files can have only 60 observations. According to the author, Bruce Gates, this restriction was imposed to

save storage space on floppies—the templates take up 165K. Gates is mulling over the idea of adapting the templates for hard disks. He is also planning to fix a problem in the manual data-entry mode, which requires you to specify the number of observations *before* you start entering data. If your count is wrong, you might lose the data and have to start over (I did this twice). Moreover, a general disadvantage of forecasting with *1-2-3* is execution speed. For example, you should expect to wait 30 to 40 seconds for regressions to run.

CompuCast

CompuCast, another beginner's template for Lotus's *1-2-3*, has much greater deficiencies. For some reason, the author of this program did not use the macros for the menus built into *1-2-3*: The *CompuCast* menus are just lists of macros in the body of the spreadsheet. I was particularly irritated by the manual, which is so full of jokes and cute sayings that it was hard to figure out what the program does, which really isn't much.

CompuCast computes seasonal adjustment factors by simply averaging the same months—it averages all January figures, then all February figures, and so on. Although I don't have the space to explain it here, there are far more accurate ways to calculate seasonal adjustment. Then the program asks you to put in an "eyeball" estimate of a straight-line trend, which is extrapolated into the future and adjusted for seasonality. If this is all you want to do, write your own template and save yourself $90.

Graph n' Calc

For people other than *1-2-3* users, a good beginner's choice is *Graph n' Calc*, a program that has been around for a while. *Graph n' Calc* is bundled with a decent introductory book on forecasting and includes a set of easy-to-use models for seasonal adjustment, regression, and time series forecasting. It also offers standard graphics (bar, stacked-bar, pie, line), DIF format file handling, a desk calculator, the ability to calculate net present value and internal rate of return, and a few general statistics functions. The program also has a weird sort of

spreadsheet that does row arithmetic only. One warning, however: *Graph 'n Calc* has to be booted with the original systems disk.

As you'll soon discover, good programs can help improve your business forecasting. ∎

N.B. Forrest is a general business consultant based in Carlisle, Pennsylvania.

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CIRCLE 229 ON READER SERVICE CARD

New on the Market

HARDWARE

Short Port Color Card

A color/graphics adapter with lightpen interface that fits the short slots in the IBM PC-XT and Portable PC systems, freeing full-length slots for other uses. Available options include a 25-pin Centronics parallel interface and composite video output capability.

The Persyst Short Port Color Card produces 7 × 7 dot graphics characters in an 8 × 8 dot field. Other graphics mode specifications include four-color high resolution of 320 × 200

pixels as well as one-color high resolution of 640 × 200 pixels. Alphanumeric display mode is 40 characters by 25 rows in low resolution; 80 characters by 25 rows in high.

The board uses the standard IBM 256-character set and provides 16K of on-board memory accessible by the Direct Memory Access (DMA) circuitry of the user's system. The RGB interface is a standard 9-pin D-shell with direct drive at TTL levels, 3 milliamps for high levels, and 16 milliamps maximum for low levels. Horizontal and vertical sync are positive polari-

Short Port Color Card, Emulex Corp.

ty. For the optional composite video interface, the polarity is negative and the level is 1 volt peak-to-peak.
(List Price: Without options, $220; with parallel port, $245)
Emulex Corp.
3545 Harbor Blvd.
Costa Mesa, CA 92626
(714) 662-5600
CIRCLE 649 ON
READER SERVICE CARD

SLIM 2000

A hard disk with cartridge tape subsystem, offering 10 megabytes of formatted storage on the hard disk and on each tape cartridge. The unit connects to the user's system via a single interface card for both components of the unit.

The enclosure, designed to closely complement the IBM PC, also contains power control and surge suppressing circuitry. Power for up to three external devices can be controlled from the SLIM 2000's front panel switches.
(List Price: $2,995)
Datatron, Inc.
Enhancement Products Div.
2942 Dow Ave.
Tustin, CA 92680
(714) 544-9970
CIRCLE 644 ON
READER SERVICE CARD
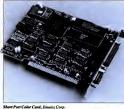
Digital Oscilloscope Peripheral, Rapid Systems

Digital Oscilloscope Peripheral

A standalone unit that allows the user's system to act as a digital oscilloscope. Specifications for the four-channel device include a 2 millihertz sampling rate, a 500 kilohertz analog bandwidth, and diode protection at all inputs.

Included software allows menu-driven operation of the device, with variable time base values and polling of channels.
(List Price: $499)
Rapid Systems
5415 136th Pl. S.E.
Bellevue, WA 98006
(206) 641-2141
CIRCLE 648 ON
READER SERVICE CARD

New on the Market Submissions Guide

Owing to the high volume of new product materials received each week at PC, all submissions to New on the Market should follow these guidelines:
1. Include the retail price and details of both hardware and software needed for an end-user to properly use your new product. This includes required amount of RAM, number and type of drives, operating systems supported, and peripheral equipment needed.
2. Releases should be typewritten double-spaced on one side of the paper. Copies of advertisements may be included, but in most instances we need more information than is typically included in an ad. Include telephone contacts for marketing and technical questions.
3. If available, include black & white glossy photos of the product, 4 × 5 inches or larger.
New on the Market does not review products; do not send sample or demo copies of software. All product announcements are run on a space-available basis, at the exclusive discretion of the editor. Please note that it is impossible to guarantee publication of a product announcement for any particular issue.

KEYPORT 300 Touchpad, Polytel Computer Products Corp.

KEYPORT 300 Touchpad with KEYWARE Development System

A programmable touchpad offering 300 function key areas. These areas can be individually programmed for particular applications and labeled by using graphics overlays.

The *KEYWARE Development System* software permits advanced users to program the touch areas on the KEYPORT 300 board to perform a variety of functions for other users. Features include macros to pause for user-input, on-line definition of KEYPORT/PC keystroke sequences, and the ability to create custom help windows that can be linked for use as a tutorial or running demo.

(List Price: KEYPORT 300 touchpad, $195; KEYWARE Development System, $249) Polytel Computer Products Corp. 1250 Oakmead Pkwy., #310 Sunnyvale, CA 94086

CIRCLE 646 ON READER SERVICE CARD

DM4962X Modem

A 9,600 bits per second modem meeting the proposed CCITT V.32 protocol standard. It is capable of 9,600/4,800 bps data transfers over standard two-wire phone lines in either asynchronous or synchronous operations, with automatic speed and bit rate selection to match the remote end of a connection.

Other features include local or remote soft-strap configuration, a built-in adaptive equalizer and echo-canceler, auto-dial and auto-answer functions, and diagnostic capabilities. The DM4962X modem also includes an interface for use with a four-port synchronous multiplexer.

(List Price: Available from the manufacturer) British Telecom Business Systems 23 Howland St. London, W1P 6HQ GB (011-44-1) 631-2122 (011-44-1) 631 2078

CIRCLE 658 ON READER SERVICE CARD

Sakata SP-1500 Printer

A dot matrix printer capable of print speeds up to 180 characters per second. Equipped with both friction and tractor feed mechanisms, it can accept continuous fanfold, cut sheet, or roll paper. It can also reverse-feed the paper, allowing multiple passes on printouts.

Other features of the printer include a 3K RAM buffer, a user-definable 256-character set, and built-in international, italic, pica, elite, condensed, double-width, and super/subscript fonts. It is equipped with a Centronics parallel interface, and has a serial interface available as an option.

(List Price: $585) Sakata USA Corp. 651 Bonnie Ln. Elk Grove Village, IL 60007 (312) 593-3211

CIRCLE 651 ON READER SERVICE CARD

ExpressData 12i

A plug-in, 1200 bps modem that the user can upgrade at any time to 2400 bps. It also features adaptive equalization, which permits the

modem to adjust automatically to varying phone line conditions.

The ExpressData 21i modem features Hayes protocol compatibility and asynchronous full- or half-duplex operations, as well as auto-dial and auto-answer functions.

Relay, a communications program that comes with the modem, supports PC-to-PC and PC-to-mainframe communication, provides password and encryption security, and directly emulates IBM 3270 terminals. It also performs data compression, effectively raising data transfer rates. Alternatively, the modem will work with most other communications software, including *Crosstalk*, *Smartcom*, *PC-Talk*, and others.

The ExpressData 12i meets Bell 103 and 212A standards, operates at 1200, 110/330 bps, and is compatible with most modems at the remote end of a connection. Voice/data switching under software control allows the user to alternate between voice and data communica-

ExpressData 12i, Telenetics Corp.

tion within the same call.
(List Price: $495)
Telenetics Corp.
895 E. Yorba Linda Blvd.
Placentia, CA 92670
(714) 524-5770

SpiderNet

A low-cost local area network permitting up to six serial devices to be linked interactively. These devices can consist of as many as five PCs and one peripheral. All functions are selectable from any port, and the LAN automatically detects and uses the proper transfer rates for communications between devices, from 110 to 9,600 bits per second. This permits devices with differing bps rates to be interconnected at any two ports.

Other features include a built-in date and time clock, support for XON/XOFF and CTS/DTR protocols, and complete software control of RS-232 lines. Available options include a Security version, which intercepts incoming calls and requests password clearance before permitting connections to be completed, and a system multiplexer, allowing data from up to five lines to be combined to the sixth.
(List Price: Standard or Security version, $495; Multiplexer, $495)
Arisoft Inc.
2450 E. Speedway #4
Tucson, AZ 85719
(800) 821-6010
(602) 327-4305

PCVISION Frame Grabber, Image Technology Inc.

PCVISION Frame Grabber

A plug-in board permitting the user to capture, store, process, and display images taken by a standard analog video camera. The board features 8-bit digitization and the ability to generate false color images from monochrome input.

PCVISION can display images on a monitor with a resolution of 512 × 480 pixels. Each pixel can be displayed in one of 256 possible levels of grey or in one of 256 colors from a palette of 16 million.
(List Price: $2,995)
Requires: ImageAction software, RS-170 analog video camera.
Image Technology Inc.
600 W. Cummings Pk.
Woburn, MA 01801
(617) 938-8444
Telex: 94-8263

dClock

A real-time clock/calendar circuit board that is user-installable directly onto a PC

motherboard rather than into an expansion slot. The device automatically enters the correct date and time whenever the system is booted.
(List Price: $59.95)
Microsync, Inc.
Computer Products Dept.
P.O. Box 116302
Carrollton, TX 75011

OCTOCOM

A plug-in adapter permitting the user to add up to eight serial ports to a PC system. OCTOCOM modules, which attach to the adapter board via a single ribbon cable, allow applications software to access the additional ports by using COM3-COM8 in place of the standard COM1-COM2 designations.

OCTOCOM's features include Programmable Array Logic (PAL) address decoder and interrupter circuitry, used to configure a system for specific applications. OCTODRIVE software, available as a separate product, provides a software-installable PC-

DOS and BASIC device driver.

OCTOCOM modules are available with four, six, or eight channels.
(List Price: 4-channel module, $295; 6 channels, $345; 8 channels, $395; interfacing cable, $75; OCTODRIVE software, $25)
Star Gate Technologies
P.O. Box 764
Cleveland, OH 44026
(216) 292-5390

MS-200 Image Scanner

A desktop image scanner that can accept documents up to 8½ by 24 inches. It digitizes the image at 200 pixels per inch resolution. Using data compression techniques, the MS-200 can compress text at a 10:1 ratio, with a comparable compression ratio for graphics. This substantially reduces the disk space and system memory required to store images.

The MS-200 Image Scanner offers switch-selectable scanning modes for text, picture, or mixed images. In mixed mode, up to four picture windows are permitted.

Documents are scanned and moved one line at a time while the optics assembly remains stationary. This method minimizes misalignment common in scanners with moving optics assemblies.
(List Price: $1,700)
Microtek Lab, Inc.
17221 S. Western Ave.
Gardena, CA 90247
(213) 538-5369

SOFTWARE

EASEL, Version 1.1
An applications development tool used to create independent, PC-based user interfaces for remote mainframe applications. Systems developed under *EASEL* let PC users interactively access, manipulate, and manage mainframe data and applications, using displayed symbols instead of syntax-sensitive commands.

For software developers, *EASEL* permits the rapid development of user interfaces without requiring modification to the mainframe applications software. If desired, *EASEL* can use such hardware as high-resolution color graphics, touch-sensitive screens, and digital mice to enhance the developed interface.

Since *EASEL* is application- and device-independent, it can be used for almost any application. Advanced prototyping capabilities permit the developer to design interface screens without actually linking to the target mainframe application during development.

EASEL's other features include support for the Diablo color ink jet printer; built-in textual regions for inserting, moving, editing, and deleting blocks of text on the screen; and automatic redrawing of edited graphics to speed the creation of complex presentations.

The basic *EASEL* package contains two authoring licenses, ten end-user application licenses, two training

EASEL, Interactive Images, Inc.

course credits, documentation and training manuals, custom development support and training, and six months free maintenance.
(List Price: $24,000; additional run-time licenses, $890)
Requires: 512K RAM, two 360K drives, PC-DOS 2.x, color/graphics adapter.
Interactive Images, Inc.
600 W. Cummings Pk.,
a4500
Woburn, MA 01801
(617) 938-8440
CIRCLE 627 ON
READER SERVICE CARD

Menu System Manager
A utility for organizing applications programs and DOS routines. *Menu System Manager* allows any DOS command or program file (.EXE, .COM, .BAT) to be

menu-driven. After execution returns to the menu, permitting other programs to be activated with minimal keystrokes.

The utility can assign password security control to any menu entry and maintains an automatic log each time the system is accessed. The log files contain such data as date, time, user I.D., commands executed, and purpose of the access, useful in compiling system-use reports for such purposes as tax accounting. The utility is RAM-resident, though it does not require RAM beyond the needs of the applications program invoked.

Menu System Manager allows the user to create an unlimited tree structure of menus with a maximum of 40 entries per menu. User-

designed screens can include two header lines, a date and time display, and a selection of foreground, background, and border colors if used on a color system. The program also features automatic screen blanking and cursor-controlled selections.
(List Price: $129.95)
Requires: 128K RAM, one disk drive, PC-DOS 2.x.
Gurdak Software Development
158-B Mereline Ave.
W. Patterson, NJ 07424
(201) 785-2498
CIRCLE 661 ON
READER SERVICE CARD

GTP Program Development System
An automatic screen format generator for Borland International's Turbo Pascal. *GTP* permits the programmer to create program displays interactively, for which the software generates source code.

GTP features include built-in database update and retrieval functions, automatic field editing, arithmetic and table lookup functions, and full keyboard utilization. The software is written in Turbo Pascal, allowing the user to extend its functions as desired.
(List Price: $99.95)
Requires: 96K RAM, one disk drive, PC-DOS 2.0, Turbo Pascal 2.0.
Allen, Emerson & Franklin, Inc.
P.O. Box 28
Katy, TX 77449
(713) 391-8570
CIRCLE 659 ON
READER SERVICE CARD

The Recipe Writer,
At-Your-Service Software, Inc.

The Recipe Writer

A recipe management program capable of storing thousands of recipes and retrieving those that meet user-defined criteria. Recipes that use procedures already defined in other recipes can be linked, eliminating repetitious data entry. In addition, the program can print lists of ingredients and compose shopping lists of ingredients from all the linked recipes.

Other features of the program include the ability to convert serving amounts instantly and to note bibliographical data such as the magazine or cookbook in which the recipe appeared.
(*List Price: $150*)
Requires: 128K RAM, one disk drive, PC-DOS.
At-Your-Service
Software, Inc.
309 W. 97th St.
New York, NY 10025
(212) 866-2186
CIRCLE 635 ON
READER SERVICE CARD

onTime

A scheduling system capable of performing control as well as planning functions. Written in *dBASE II*, onTime

releases jobs by priority, following either a schedule it develops from user-established dispatching rules or a user-created schedule.

The scheduling system does not use either the critical path method or material requirements planning approaches to establishing schedules. Instead, the user is prompted to define key resources (personnel, equipment, etc.) and task assignments. Next, the user enters the dispatching rules to be followed (first come first served, least processing time, least slack-time, worst lateness, and so forth), by which the software determines the queuing order for processing jobs.

onTime can aid in tracking job costs by establishing actual hours worked, percentage of work completed, and work remaining for completion. It computes job costs and calls attention to schedule variances, pinpointing the areas where the job flow varies from original projections.

Because the program is written in *dBASE II* and has source code provided, the user may easily customize reports, add features, and interface the system to other applications. onTime is also compatible with *dBASE III.*
(*List Price: $495*)
Requires: 128K RAM, two disk drives, PC-DOS, *dBASE II* or *dBASE III.*
Wyman Associates
525 California Dr.
Burlingame, CA 94010
(415) 343-3900
CIRCLE 660 ON
READER SERVICE CARD

DATAWRITE Corporate General Ledger

A general ledger system compatible with either PC-DOS or XENIX operating systems. A major component of the software, the *DATAWRITE Matrix Report Writer,* allows the user to specify any accounts in any order while preparing reports, as well as to change account descriptions without affecting the basic chart of accounts.

The reporting facility also allows page columns, headings, subtotals, and totals to be printed or displayed in any format desired. This permits the user to create a li-

brary of stored management and financial reports for an unlimited number of journals and charts of accounts.
(*List Price: $2,995*)
Requires: 256K RAM, two disk drives, PC-DOS or XENIX.
Accountants Microsystems Inc.
3633 136th Pl., S.E.
Bellevue, WA 98006
(206) 643-2050
CIRCLE 641 ON
READER SERVICE CARD

FASTWARE TMS 3.0

An enhancement utility for PC-DOS that reduces disk access times by as much as a hundredfold. *FASTWARE*

DATAWRITE Corporate General Ledger, Accountants Microsystems Inc.

TMS 3.0 accomplishes its rapid data accessing by setting up a portion of RAM in the user's system as its own disk caching and print buffering reserve.

The utility, which also cuts hard disk-to-floppy backup times by 50 percent, can operate with as little as 16K RAM. It is transparent to PC-DOS and is installed without modification to either the user's hardware or applications software.
(List Price: $60)
Requires: 128K RAM, one disk drive, PC-DOS.
THESYS Memory Products
7345 E. Acoma Dr.
Scottsdale, AZ 85260
(602) 991-7356

CIRCLE 634 ON
READER SERVICE CARD

PrinScil
A printer configurator utility allowing the user to access a printer's features without programming escape or other control codes. Features include menu-driven selection of printer options and the ability to save configurations to disk for later reuse.

PrinScil supports printers using the IBM, Epson, Okidata, and Mannesmann Tally printer control codes.
(List Price: Single Printer Version, $29.95; Multiple Printer Version, $49.95)
Requires: 128K RAM, one disk drive, PC-DOS 2.x, compatible printer.
SofScil
13812 S.E. 240th
Kent, WA 98042
(206) 631-4212

CIRCLE 633 ON
READER SERVICE CARD

F*I*F
A program-development aid for BASIC, simplifying the programming of data input screens. Designed to be used by the novice BASIC programmer, it provides an automatic means of obtaining compact BASIC subroutines that can be accessed by simple GOSUB commands.

*F*I*F*, which stands for *Fill-In-Formats*, allows up to nine different screen formats for each program under development. Each format can have up to 50 data entry fields, and the length of a field can range from one character position to an entire line. Formats can be color or monochrome, with a width of 40 or 80 columns.

All subroutine code created under *F*I*F* can be compiled; also, a subroutine's operation may be previewed before it is merged with the main program.

F*I*F, Siskiyou Software

(List Price: $49.95)
Requires: 128K RAM, one disk drive, PC-DOS 2.x.
Siskiyou Software
830 Garden Way
Ashland, OR 97520
(503) 482-1908

CIRCLE 632 ON
READER SERVICE CARD

LYNC 4.1
A communications program for the IBM PCjr, allowing it to communicate with on-line data and telex services, mainframe systems, and other microcomputers. The program permits automated logon and send/receive routines, unlimited-length batch files, unattended operation, and password protection.

In addition to these features, *LYNC 4.1* can also set parity and bit length rates automatically, sensing the requisite parameters from the system being called. Error-checking protocols include Xmodem and a proprietary protocol.

The program will also work with any other modem-equipped IBM PC system at rates up to 9,600 bits per second.
(List Price: $195)
Requires: 64K RAM, one disk drive, PC-DOS 2.1.
Norton-Lambert Corp.
P.O. Box 4085
Santa Barbara, CA 93103
(805) 687-8896

CIRCLE 630 ON
READER SERVICE CARD

SRMS (Software Revision Management System)
A set of related utilities to help software developers keep track of changes to the source code of computer programs. *SRMS* allows specific versions of a program to be retrieved and records pertinent data on changes as they are made.

All versions of the program under development are stored in a single *SRMS* library, without duplication of common code or text. This allows different versions of a program to be stored together on disk while using only slightly more space than required for a single version.

SRMS also permits changes to be made without conflict to older versions of a program while newer versions are being developed.
(List Price: $69.95)
Requires: 128K RAM, two disk drives, PC-DOS 2.x.
Quilt Computing
7048 Stratford Rd.
Woodbury, MN 55125
(612) 738-6793

CIRCLE 664 ON
READER SERVICE CARD

GoldenYears

A tool for investigating the financial aspects of retirement planning. With *GoldenYears*, the user specifies current and anticipated retirement financial profiles, entering such data as current income, expenditures, invested capital, anticipated inflation rates, and years remaining before retirement.

GoldenYears then performs a series of equations to determine whether the desired post-retirement standard of living can be achieved. If it cannot, the program indicates adjustments that can be made in the current standard of living to achieve the desired goals.

GoldenYears also estimates the maximum post-retirement standard that can be achieved with any given current profile, and the maximum retirement period that can be achieved without altering either current or desired profiles.

(List Price: $125)
Requires: 128K RAM, one disk drive, PC-DOS.
JCW Enterprises, Inc.
25150 Thorndyke
Southfield, MI 48034
(313) 353-7492
CIRCLE 626 ON
READER SERVICE CARD

ACCESSORIES

Qualtec Security Products

Three security products designed to protect a user's hardware and software. The products, PC-LOK, FILE-LOK, and DATA-LOK are secure confidential data files, PC boards, hard disks, computers, and peripherals.

The PC-LOK device covers the power switch and the back panel, preventing access to the user's system and internal circuitry. The lock is constructed from ¼-inch aluminum.

FILE-LOK protects a full-height 5¼-inch floppy disk drive even while the drive is in operation. It will also stop a floppy drive from copying hard disk data files by denying access to the diskette within the drive.

The DATA-LOK software requires that a ten-character user-selected password be entered in order to access confidential data files.
(List Price: PC-LOK; $149.95; FILE-LOK, $17.95; DATA-LOK, $99.95)
Qualtec Data Products, Inc.
1400 Coleman Ave., aD23
Santa Clara, CA 95050
(408) 496-0184
CIRCLE 640 ON
READER SERVICE CARD

COOL IT

A replacement cooling fan kit with a replacement filter element. The low-noise COOL IT fan is mounted to the outside of a component's enclosure, requiring no tools or technical ability for installation. The fan is available in black, beige, grey, and white.
(List Price: COOL IT Fan, $39.95; replaceable Filter 5 Paks, $4.99)
Proto PC Inc.
2439 Franklin Ave.
St. Paul, MN 55114
(612) 644-4660
CIRCLE 643 ON
READER SERVICE CARD

Stelex Computer Furniture, Stelex Corp.

Stelex Computer Furniture

A line of steel office furniture designed specifically to hold PC equipment, providing both convenient placement of components and protection against theft. The Stelex line includes variously sized desktops, legs, keyboard drawers, CPU pedestals, and adjustable monitor support arms.

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This is a full-page advertisement for Eastern Enterprises, Inc.

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Compact Work Desk, Bush Industries, Inc.

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PC Product Index

PC PRODUCT INDEX

Dishing Up Computer Tidbits

Two books offer the voracious reader ample food for thought: One presents a smorgasbord of computer lore; the other examines the ingredients that make up today's computing environment.

I began with cute jokes about food processors to word processors and poor puns on jargonese like menus, bytes, and nibbles. Now the analogy between food and computers has become something of an industry standard. Two books, *Digital Deli*, edited by Steve Ditlea, and *The Computer Cookbook* by William Bates help perpetuate the metaphor of computers as "food for thought." Both books give readers plenty of computer memorabilia for their money. The first is an impressionistic collection of essays, the second a more mundane encyclopedia of facts. Both will fill hungry minds with juicy tidbits about the computer industry.

A Movable Feast

Digital Deli is laden with history, trivia, opinion, and well-written chronicles about the plight of Everyman in the computer age. The menu (or table of contents) at the *Digital Deli* offers short, upbeat essays documenting the lore and lure of the computing world. These deli delights are culled from a group of pop-culture–loving, computer-supporting journalists and industry specialists who call themselves the Lunch Bunch.

The Lunch Bunch contributors include Stephen Levy, author of *Hackers*; Nolan

Bushnell, founder of Atari; Dan Bricklin, producer of *Visicalc*; Peter McWilliams, the world's "cutest" computer author; computer visionary Ted Nelson, and Mitch Kapor, founder of Lotus. Each author gets three or four pages of large-format, well-produced type. Esther Dyson (*Computer Industry Daily*) explains why the Macintosh is the industry's equivalent of the "short ski" GLM method. Michael Berlyn and Marc Blank (Infocom) talk about the future of interactive fiction and the structure of computer adventure games, and Ken Uston explores the computer's potential as a gambling machine.

More than just a vertical selection of computer hackers, *Digital Deli* features input from Henny Youngman (Take My Computer, Please), William Buckley (The Conservative Computer), Timothy Leary (Personal Computer, Personal Freedom), and Ray Bradbury, among others. The book's recipe for success is to let the flavor of each author come through.

Organized on the menu theme, *Digital Deli* features over 100 computer chefs, offering almost 400 pages of selections. "Appetizers" sets the historical stage of computing, and "Personal Choices" is a forum for authors to bare their souls about their favorite machines. "Word Salad" offers an assortment of popular computer languages; "Creative Combos" looks at computers and their bedfellows in the arts; and "Tomorrow's Specials" discusses the futuristic dessert. "Fresh Greens" focuses on big money issues, while "Family Favorites" looks at the computer widow, what kids, computer dating, and other sociological marvels. Philosophers will enjoy the "Brain Food" selections on expert systems and AI Globalists will want to read the excellent accounts on the state of computing abroad. All the selections are idiosyncratic, and I found them marvelously entertaining.

Chacun à Son Goût

The *Digital Deli* will not satisfy everyone's taste, however. The writing tends to

ward "hip" and is based on the highly personal experiences of each writer. True to the pop journalism ethic, the book can be faulted for slanting issues, for Gonzo journalism, and for an over-reliance on high-flown epistemological terminology. The essays create moods and impressions as much as they impart fact.

In *Digital Deli*, the computer is a paradigm for life itself: In understanding it, we understand ourselves; in exploring it, we explore ourselves; in extending its capabilities, and applications, we extend our own. Take the Lunch Bunch out for lunch—you won't be sorry.

The Computer Cookbook

The Computer Cookbook is a well-written, information-laden book in search of an audience. Now in its fifth edition, the book is decidedly more topical and less oriented toward giving "helpful hints" than in earlier editions.

More than 125 topics are tackled in its 400 large-format pages, but just who would use such a book remains a mystery to me.

Organized alphabetically as an encyclopedia of computer-related information, *The Computer Cookbook* provides a comprehensive introduction to computer basics and current computer technologies. The collection is more than a computer dictionary but less than a technical reference. The articles tackle technical material, industry news, product information, and controversial opinion in a clear, concise manner. An extensive listing of software and hardware manufacturers and distributors is given. The listings include a synopsis of each entrant's contribution to the field.

A Bountiful Banquet

The Computer Cookbook offers few recipes for successful computing, but it

does provide a careful look at the fundamental ingredients of the computing environment. As the reader sojourns alphabetically, from accounting and Ada through writing style and Xerox, he will notice that each topic is treated in the cool, calm manner of technically competent journalism.

Some of the topics impart helpful information about the way things work—for example, the sections on modems and light pens. Some of the sections—like education, software publishing, and artificial intelligence—barely scratch the surface, but others, like agriculture and law, give readers a feeling for a specific computing milieu. The book treats computer languages in a careful, unbiased way and emphasizes the generic features of fundamental software applications like spreadsheets, word processing, and databases.

All reference books, especially those

on computers, have intrinsic problems. *The Computer Cookbook* suffers from the weaknesses of the genre. First, many important topics are neglected or referenced in an obscure fashion. Some of the critical omissions include topics like computers in medicine, science, and architecture. Moreover, a computer reference book has a terribly short shelf life: It's usually dated by the time it hits the streets. In this respect, *The Computer Cookbook* starts out at a disadvantage: It contains nothing on Tandy's newest PC clones, and there's no mention of AT&T at all. For every product that is discussed, at least ten important ones go unmentioned altogether.

Another problem is that some of the information in the book—like the instruction sets for popular microprocessor chips, printer escape sequences, and commands for software packages—are descriptions intended for a very different set of readers than those who want to know what a portable computer or plotter can be used for. The book sacrifices unity by trying to be all things to all people.

Using *The Computer Cookbook* as a basic reference is akin to using the encyclopedia to learn history. You'll learn enough to hold your own at cocktail parties, but not much more. It's the sort of book that grandmothers might buy for their computer-generation offspring at Christmas.

Something for Everyone

Nonetheless, *The Computer Cookbook* is illuminating and manages to have something for everyone. The easy-to-read style, graphically attractive layout, and carefully chosen subjects will help you understand the working nature of the

computer universe. Novices can use it as a stepping stone to aid their travels, and old timers will find a refresher course in the state of the art. Reference books are often something to be leery of, but while

this book has some of the weaknesses of the genre, it is well done. ■

Robin Raskin is a frequent contributor to PC Magazine.

TECH JOURNAL
FOR IBM PERSONAL COMPUTER USERS

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SNA Strategies
Linking a PC to a mainframe isn't as difficult as it seems—if the existing SNA infrastructure is utilized. *PC Tech Journal* introduces IBM's System Network Architecture (SNA) and offers four strategies for bridging the micro/mainframe gap as well as thoughts on combining micro/mainframe communications with local area networks.

PGC and VX/PC
An in-depth review of two sophisticated products for graphics professionals: IBM's Professional Graphics Controller and the VX/PC from Vectrix.

COBOL
In continuing coverage of the migration of COBOL to the PC, *PC Tech Journal* will review compilers from Microsoft, Micro Focus, and Digital Research.

Tools for C Programmers
Window libraries allow C programmers to partition single applications with windows and update these windows independently. The second part of a three-part series, "Tools for C Programmers," compares six window libraries.

PC/IX
IBM's single-user entry in the UNIX market, PC/IX, is put through its paces in *PC Tech Journal*'s investigation of implementations for the IBM XT.

Pocket APL
PC Tech Journal looks at Pocket APL, a new package from STSC, the makers of APL-Plus, which provides an inexpensive introduction to the APL language.

Dot Matrix Typesetting With LePrint
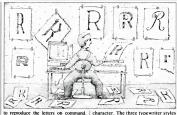
LePrint turns your dot matrix printer into a typesetting shop—without complicated typesetting codes. It can produce 13 different typefaces in sizes ranging from ½ inch to over 10 inches.

An expensive daisywheel printer is not the only way to obtain true letter-quality print from a computer system. Nor do you have to shell out money to your local printer to get typeset material. A new program, called *LePrint*, turns your dot matrix printer into a typesetting shop. With any one of 38 supported printers, it can produce 13 different typefaces, ranging in size from just ½ inch to over 10 inches. What's more, you can use these different typefaces and heights within the same line of text.

And *LePrint* doesn't require any complicated typesetting codes. It works with *WordStar* and ASCII files by using several special dot commands. (LeBaugh plans to release versions of *LePrint* that are adapted to other word processors soon.) For example, to print the text "Now we have ¼ inch Helvetica" in Figure 1, you insert the command ".fa helvetic" to specify Helvetica typeface and then type ".ch .25 in" to select letters 0.25-inch high. *LePrint* also accepts character heights in centimeters, millimeters, picas (about ¹/₁₂ inch), points (about ¹/₇₂ inch), and several other systems of type measure.

Digitized Typefaces

To produce this typesetting magic with inexpensive dot matrix printers, the developers of *LePrint* have taken a number of common type styles and digitized them. By enlarging each letter on a screen, they were able to assign digital values to the form of each letter and translate these values to computer code

to reproduce the letters on command. This process is possible because the computer can control each dot that forms the typed letters.

LePrint offers five standard typefaces and eight optional typefaces (see Figure 1). The program has easy-to-understand menus and lets you select choices in one of two ways, either by moving the cursor and pressing the Enter key or alternatively by entering a highlighted letter. If you make an error, the screen tells you nicely about the problem.

Typewriter Type Styles

The standard set of typefaces consists of three monospaced typewriter styles and two proportional typefaces. Most electric typewriters and dot matrix printers display monospace type, which allots the same amount of space to each character. The three typewriter styles available in the basic *LePrint* program are Courier 10, Pica 10, and Prestige Elite 12.

Proportionally spaced print varies the

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Illustration: Peter Sin

space allotted to a letter depending on the letter's width, producing a more even and pleasing look to the page. *LePrint's* standard set supplies two proportional typefaces, Times Roman and Times Italic. Times Roman, one of the most popular styles for typeset material, is the typeface used in *PC Magazine*. You can print out any of the 13 available type styles in sizes ranging from what I call "Myopic Nightmare" ($^{1}/_{13}$ inch) to something larger than the Big E on an eye doctor's vision chart.

Previewing Type

Using a color/graphics adapter, you can preview output on the screen as it will appear on the typed page; a monochrome adapter lets you see the output only in normal screen text size and not as it will ultimately appear. So the color/graphics card can be helpful if, for example, you've accidentally told the program to print letters 5 inches high when you ac-

This is default Pica size -- and the standard Prestige Elite

This is regular Letter Gothic. This is Pica type size.

This is 15 point Times Roman *and Times Italic*

Now we have 1/4 inch Helvetica and tiny Helvetica (which could be even smaller)

This is *Full Frame* and Clarendon, with a Big

Make us with English Signs

or include a line or two of Greek ααβγδεζ*μθικλμνξοπρστ∫φχψω*
ΑΒΓΔΕΖΗΘΙΚΛΜΝΞΟΠΣ ΤΦΧΨΩ

Put in Math symbols:
± × ÷ √ | ÷ − ∩ ← → ≥ ≤ ⊂ ≠ ≡ < ∞ ≈ ⊃ □

or add special symbols like:

⊕ ⊗ † ♦ ∨ | † • ∆ ◇ ⊗ □ ⊙ ↑ ⊢
∇ ∆ • ▲ ◇ ☐ ♦ ⊙ ○ ○ ○ ☆ † ↑

Figure 1: *A sampler of LePrint's typefaces.*

tually meant .5 inches high. You will see that huge letter start to form on the screen and can immediately halt the display to correct the error.

LePrint comes on three disks. One contains the *LePrint* program, an on-line help program, two files to install *LePrint*, and a test file to check your installation. The second and third disks have the type library files on them—all the information the computer needs to produce a wide variety of available letters, numbers, and symbols. The distribution disks are not copy protected. You can easily install the files on a hard disk subdirectory.

A Goofproof Installation

Over 50 help screens guide you through installation, but the process is so simple that you may never see most of them. The main program also has plenty of help screens.

To install *LePrint*, you respond to

menu choices on the screen. You have to tell *LePrint* whether you have a monochrome or color/graphics adapter and select from one of the 18 currently supported printer models. If your printer isn't listed, you may still be able to install it indirectly as a compatible printer. The company plans to continue to adapt the program to additional printers on the market. At the end of the installation process, the program produces a data file, named LP.INS, with detailed information about your computer and printer system. So, you will never have to run the installation again unless you wish to change some parameters.

Impressive Resumes

Writers can easily find a number of uses for *LePrint*, such as designing impressive resumes or ad copy. A small business that uses typesetting services to produce brochures or flyers can save a good bit of money by creating the originals with *LePrint* and then using offset printing or even photocopying if quantities are small. With *LePrint*, newsletters look as if they've been professionally printed.

For example, I recently wanted to develop a new brochure to better describe my business. I wrote the basic copy using *WordStar* and then used *LePrint* to experiment with different print sizes and

type styles until I was happy with the result. Page design by experimentation is easy—you simply change the typeface and/or character height commands in the text file.

Printing your text file is very simple. You save your file, exit to DOS, and type LP followed by the name of your text file (including PATH commands if needed), and then the printer starts buzzing away. If you're not happy with the results, you go back to your text file and change the two dot commands.

Three Printing Modes

You can print in one of three modes. Letter-quality mode produces the best print quality. Correspondence mode uses lower-resolution graphics output to print copy at a faster rate. Draft mode gives you a draft at high speed using the normal character size of your printer; in this case, the printout will show page breaks but you can't use the special typefaces.

Printing a document with *LePrint* is

> Over 50 help screens guide you through installation, but the process is so simple that you may never see most of them.

> Writers can easily find a number of uses for LePrint, such as designing impressive resumes or ad copy.

naturally slower than running off a copy with your word processor. My C. Itoh Prowriter printer normally runs at 120 cps but makes at least four passes to print one line with *LePrint*. However, other system configurations—with different print buffers and varying amounts of RAM—may give you faster or slower printing. You will probably go through ribbons faster than usual doing this kind of graphics work, but the output has to be seen to be believed. And the price seems very reasonable given the versatility of the program. *LePrint* will enhance your simple dot matrix printer output not only to letter quality, but far beyond. ∎

Charles Anderson, a professional librarian and information broker, is president of Answers Unlimited, a Chicago-based firm that specializes in indexing books and creating on-line databases.

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Coming Up

Optical Character Readers

Say you have a stack of typed pages that you'd like to have on disk so you can manipulate them with your word processor. You could spend hours keying them in, or you could avoid the bottleneck at the keyboard by running it all through an optical character reader (OCR). They range from sophisticated machines that can handle proportional spacing and gulp down full pages at a time, pictures and all, to simple hand-held line readers. All quickly and painlessly transform hardcopy into ASCII files. *PC Magazine* looks at six of the most noteworthy machines, from the $499 Oberon OMNI-READER to the $36,500 Kurzweil 4000. We also tell you about a software package designed to make your life easier by putting an OCR to work reading resumes.

Database Retrospective

It's been a year since *PC* surveyed the database management field in Project Database. What's new in today's database marketplace? In this special report by Alfred Poor, we'll fill you in on new and interesting products and intriguing updates of older products (about a dozen programs in all). We'll also explore the latest trends, keeping you in touch and up-to-date in a rapidly changing market.

Backup Software

Backing up your hard disk data onto floppies can be so tedious and time-consuming that it is a primary candidate for procrastination—paving the way for tragedy. A few companies claim to have introduced software that potentially averts hard-disk disaster by making the chore of backing up virtually effortless. Do they work? Are they easy enough for you to want to use them regularly? Winn L. Rosch has some answers.

CADkey

A new computer-aided design (CAD) program brings mainframe program features, such as 3-D, to your PC.

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